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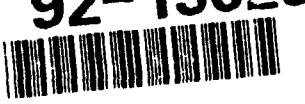
TOWARD ADVANCED HUMAN RELIABILITY PROGRAMS

STRUCTURAL DEVELOPMENT CONSIDERATIONS AND OPTIONS FOR EXTREME RISK ENVIRONMENTS

Office of Emergency Operations
White House Military Office
May 1992



REPORT DOCUMENTATION PAGE

Form Approved
OPM No. 0704-0188

1. AGENCY USE ONLY (Leave Blank)	2. REPORT DATE	3. REPORT TYPE AND DATES COVERED
	May 1992	Basic research: 10/90-6/91

4. TITLE AND SUBTITLE
TOWARD ADVANCED HUMAN RELIABILITY PROGRAMS
Structural Development Considerations and Options for Extreme Risk Environments

5. FUNDING NUMBERS

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8. PERFORMING ORGANIZATION REPORT NUMBER

9. SPONSORING/MONITORING AGENCY NAME(S) AND ADDRESS(ES)

10. SPONSORING/MONITORING AGENCY REPORT NUMBER

11. SUPPLEMENTARY NOTES

12a. DISTRIBUTION/AVAILABILITY STATEMENT
Approved for public release; distribution is unlimited

12b. DISTRIBUTION CODE

13. ABSTRACT (Maximum 200 words)
Operational populations exposed to extreme risk environments (EREs) might expect to sustain substantial losses, yet must be able to be relied upon to complete their mission or missions regardless. Existing human (personnel) reliability programs are inadequate to assure that personnel capable of meeting both the necessary security and operational requirements are available for response to such conditions. This study explores a number of issues to consider in building a robust human reliability program (HRP) structure capable of supporting single to multiple operational populations, scenarios, and missions, using any of several program structure formats. The HRP structure format may be used within a single agency or government-wide.

14. SUBJECT TERMS	15. NUMBER OF PAGES
reliability, human reliability, personnel reliability, extreme risk environments, reliability programs, psychological reliability	114
	16. PRICE CODE

17. SECURITY CLASSIFICATION OF REPORT	18. SECURITY CLASSIFICATION OF THIS PAGE	19. SECURITY CLASSIFICATION OF ABSTRACT	20. LIMITATION OF ABSTRACT
UNCLASSIFIED	UNCLASSIFIED	UNCLASSIFIED	unlimited

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Executive Summary

This study was undertaken at the direction of Major General Robert M. Marquette, Jr., USAF, Director of the Office of Emergency Operations (OEO), White House Military Office. The study explores the feasibility of establishing a personnel reliability program for use in extreme risk environments (EREs) and identifies issues pertaining to program implementation. Upon review of background material and existing military and intelligence programs, it became obvious that:

1. Existing programs are inadequate to provide the necessary degree of assurance that they, and their populations, would be able to accomplish their purposes in the event of exposure to EREs.

2. Unclassified human reliability programs are not required to be functional during an extreme risk environment situation.

3. In the absence of specific scenario or threat, it would be necessary to examine application of a program structure or framework from the standpoint of usability in a single on up to multiple threat/population/agency approach.

A multifaceted approach was taken to find or develop solutions to the problems noted above in order to effectively conduct the study. During the course of this nine month, part time effort, a multi-agency team was created to identify professional sources of information. Two dozen psychologists, psychiatrists, and other professional specialists from a number of Government and non-Government organizations were consulted both to obtain the most pertinent information in highly condensed form and to identify academic sources of information. Six national scale databases were thoroughly examined for relevant information and reports. Over one hundred scientific papers, six books/compendia reports, and nine Federal Government regulations were obtained for background research. Several key conclusions emerged from this process:

1. Without a reliability program designed to deliver personnel specifically selected for operational service in particular ERE scenarios, there were minimal chances that enough personnel would be available, or able to function, to provide an effective response to the ERE.

2. Scientific research has not been conducted in the area of human reliability in virtually any EREs.

3. Measurement tools or instrumentation for application in EREs has not been developed, but can be.

4. No existing reliability program integrates operational functionality and human performance issues in EREs with suitability issues in a context applicable to more than the narrowest and most limited of mission applications.

5. There are a number of subtle factors affecting human reliability that must be examined in detail and integrated into a program as a whole in order to provide the greatest assurance of success in EREs. These include decision making in extreme risk environments, team decision related issues, cohesion and infrastructure, coping strategies, interpersonal conflict potentials, and others.

6. There are also a number of subtle factors that have great validity in some or most ERE scenarios that should also be considered in detail and integrated into a program as applicable in order to provide even greater likelihood of success. These include stress training, crosstraining, motivation and responsibility factors, phased deployment, personal relationship issues, and others.

With all these factors manifest and bearing in mind the variety of potential candidate populations and their specific needs, a number of highly versatile architectures were developed to construct a program from. These include five front end selection and four monitoring models, and differing validation and intervention mechanisms. The structures and models will all accommodate at least some reconfiguration as well. The format is designed to be filled in with specific tools to address the specific needs of particular populations and scenarios. Sixteen recommendations are made in the text and are summarized at the end of it. A seventeenth would be appropriate to place here, as it is the most important of all:

<u>A human reliability program should be developed to ensure that adequate numbers of personnel capable of meeting both the necessary security and operational concerns are available for response to extreme risk environments.</u>

Table of Exhibits

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Section I. Introduction

The following study was prepared for the Director of the Office of Emergency Operations (OEO), Major General Robert M. Marquette, Jr., USAF. Its primary objective is to provide a vehicle for lay decision makers regarding the utility, applicability, development, and coordination of highly advanced, extremely flexible, human reliability program (HRP) structural formats designed to factor for a significant number of pertinent variables of both security and operational significance. It does however also seek to address issues, configurations, and coordination requirements of interest to the scientific community as well.

The complexity of tne task undertaken in this volume was increased by the requirement to simultaneously address the disparate needs of a variety of candidate populations exposed to particularly hostile conditions where substantial casualties might be anticipated, but in which personnel were needed who could meet both significant security requirements and also perform under conditions they and/or those close to them might not survive--what are defined herein as extreme risk environments--in a single HRP. Therefore, although general areas of concern that apply to all potential extreme risk environment (ERE) populations are addressed in the following sections, models for this study are designed to address multiple population needs and formats in a single, overarching HRP format.

It also became apparent as research on this study progressed that conventional personnel (human) reliability programs do not explicitly address consideration of operational performance factors in the security screening and monitoring process. These factors have been addressed in this study as part of an integrated program.

A. ACKNOWLEDGEMENT

This report differs in approach from most others on the topic in that it relies heavily on the practical experience of a number of highly talented people, many of whom currently operate in or upon human reliability programs. Additionally, the capable support of United States Army Military Intelligence personnel was available to identify persons to interview for this study and to assist in searching out reference material. Persons who participated in this effort are included below: all have heartfelt thanks for their support, and in many cases, enthusiastic encouragement. Thank you all so much:

S/A Lee Anklin, USA

S/A Donald Brenno, USA
Mr. Mark Centra
CAPT Chandler, USN
MAJ Ronald Chapman, USAF
S/A Ann Clawson, USA
Dr. Kent Crawford
Ms. Lorna Dodt
Mr. Pat Dowd
Dr. Douglas Eddy, NTI Inc.
Dr. Joe Fagan, USA
Dr. Edna Fiedler
Dr. Edwin Gerwell, USAF
Dr. Harold Ginzburg
Dr. Fred Glogower, USN
Mr. Dewey Goff
Dr. Allan Greenwald
Dr. Martin Kurke
Mr. Richard McMurray
Mr. Robert Oppenheimer
S/A Michael Parker, USA
Dr. John Patterson, USAF
Dr. John Plewis, USA
Mr. John Reardon
Dr. Richard Rees
Mr. William Robbins
Dr. Walter Sipes, USAF
MAJ Gail Stark, USA
Dr. David Strome, SRL, Inc.
Dr. Michael Wigglesworth
Dr. Martin Wiskoff, BDM Inc.

B. TASKING

This project was assigned on October 11, 1990 to examine feasibility of development and implementation of HRP's for multiple candidate populations. Additional tasking elements supporting, amplifying, or clarifying the main themes were added by the Director, OEO at In Progress Reviews (IPR's) and have been listed as appropriate in the following material.

C. CONCEPT

The operational concepts behind the examination of a human reliability program for use in EREs differ in a number of ways from standard department of Defense (DOD) Personnel Reliability Programs (PRP's), although there are some general objectives in common (the selection and retention of reliable personnel).

One major point of variance between the OEO HRP and DOD PRP concepts is that DOD's is specifically stated in DOD 5210.42 to be a peacetime program; in time of conflict, it

may be set aside with additional manning/reinforcements not necessarily having to meet the same strict standard as the original staff. The concept presented for this study, while not necessarily intended for use in a combat environment, holds that due in part to much smaller numbers of personnel involved and the magnified damage a single individual might thus cause, in combination with their use in environments that may be fully as hazardous as direct action tactical combat, original personnel may have to persevere without hope of reinforcement or replacement, and any reinforcement or replacement personnel would have to meet the same selection criteria as original personnel. In short, functionality in EREs is as essential as mere survival. Unlike the military, this may mean a short/medium term requirement to shift existing assets rather than acquiring new ones.

There are other issues to consider. Military PRP's are governed ultimately by compliance with DOD 5210.42 of December 6, 1985, Nuclear Weapons Personnel Reliability Program. This policy document mandates in a fairly general way the requirements for selection and retention of personnel in military PRP's. Standards for selection include both qualifying and disqualifying factors. Qualifying factors stress physical, attitudinal, and behavioral characteristics, all to be decided on a purely judgemental individual basis. There is neither clarification nor explanation of how or what to assess, for example "evidence of...ability to exercise sound judgement in meeting adverse or emergency conditions" (DOD 5210.42 of December 6, 1985, Enclosure (4)). What type of conditions, and under what circumstances? The leeway is presumably allowed both for the quoted factor and the others in the reliability standards in order to allow certifying officials to factor in additional variables to assess a multitude of situations. Similar latitude is granted in medical and psychological selection, which may well be no more than a records review for approval. There are a variety of other specific weaknesses in the selection process, such as the requirement for National Agency Check (NAC) as the investigative tool for Nuclear Controlled Positions (said NAC's being adequate only to determine existence of criminal or certain other records, and not provide indication of any other aspect of a person's suitability). In sum, however, the problem with DOD type PRP's is that they attempt to cover all foreseeable variables with a uniform program application and thus are inadequate for many specific situations or population requirements. Additionally, other critical factors impact the capability of such systems to deal with a large variety of adverse factors. First, PRP selection using the DOD screening proces is primarily done in peacetime and is based upon past indications ("the best indication of reliability is past performance" per AFR 35-99 (C1), May 5, 1988, page 9) and current observations: stressors or failings are essentially everyday ones and

though these may be sufficient to "select out" someone with significant problems, they may not be adequate to address the additional extremities involved in threat to life or the lives of loved ones. Testing in support of DOD efforts concentrates on predictability of groups in current conditions, not in periods of extreme stress. Further, the major components of the selection process, adjudication and medical/psychological, are geared toward "selecting out"--accepting all personnel not contraindicated for approval by specific interpretation of the general standards. Thus the certifying official is presented with a variety of indicators and expert opinions. Only he or she has the "big picture" from all sources and thus the capability for a comprehensive selection judgement, but it is questionable how often such an official (who is also seldom trained in the selection areas he/she has experts for) might disagree with lower level recommendations based primarily on approval of all whom meet individual baseline requirements. Secondly, the DOD type selection process concentrates on front-end loading, with by far the most extensive review during selection. Monitoring relies on personal observation by designated personnel (all members of the PRP, in the case of the United States Navy, for example) whose training ranges across the full spectrum from untrained to expert, and whose rate of observation varies. Monitoring also relies on the self-reporting of participant members who may or may not be willing to do so. Thirdly, although some research has been undertaken regarding DOD's personnel security continuing evaluation programs (Crawford, Abbott) similar work was not found specifically for PRP's.

Although the general validity of the above remarks concerning DOD's programs are relatively well known, and its rare failures sometimes spectacularly so, in raw terms of failures in comparison to successes, the program must be considered overall to be quite successful.

No studies of the effects of life-threatening situations upon DOD PRP populations was found in the limited time available for this study, but a nagging suspicion remains that substantial losses might be expected under such conditions. Representatives of certain Federal agencies with PRP-like selection/retention processes of their own all admitted similar concerns for their own programs, and expected major reliability problems in the event of a significant life threat to their personnel.

For all the reasons above, it was felt necessary to focus on what additional procedures might be added to or used in lieu of existing in-place operational methodologies in order to acquire the types of human reliability selection and retention tools demanded by varying populations and missions operating in (an) extreme risk environment(s). The baseline concept was to take the best of existing human reliability system procedures for the good that might be gleaned from them and, knowing their limitations, seek means to enhance those areas that needed it to better support ERE

requirements. Also, since the first steps in establishing an HRP must be acquiring the background necessary to make effective recommendations and decisions about establishing a program and the structure or direction it might take, discussion of pertinent background areas would be necessary as a means of establishing a more level and integrated basis for the recommendations and decisions. As it became obvious in the course of this study how little existing instrumentation was suitable for direct application under the specified conditions, new mechanisms to develop the program-specific tools needed became a necessity. At the same time, flexible formatting was considered essential to meet the requirements of differing populations and agencies or departments, and these were accordingly developed.

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Section II. Methodology

A. BASELINES

The initial impression of existing HRP/PRP's gained in this study was that they were geared primarily to a behaviorally and physiologically oriented front end load process that served as an adjunct to enhance personnel security adjudication. This perception was concurred in by all persons asked during interviews conducted for this effort, and all personnel who commented agreed that such systems were inadequate to assess reliability under life-threatening conditions or stress. All commenting felt that far more work was needed in the area of post-selection monitoring as well, and that current instrumentation was inadequate for the task. Most of them did agree that suitable instrumentation could be developed, however.

The implication initially drawn from a juxtaposing of the initial assessment above and the requirements for both dependability and functionality in variable EREs was that if an overarching system could be devised that assessed these requirements, it would also cover the necessary suitability aspects of current systems while giving assurance that personnel selected would be able to maintain stability and capability in EREs. Although no interviewee disagreed openly with this analysis, it is now considered to be too simplistic and oriented to evaluation of different measurable criteria (performance vice suitability), based on a review of academic information (Driskell et al, 1990). Thus though performance does not necessarily include suitability or vice versa, they remain separate key variables for assurance of the degree of reliability needed for an assignment to an ERE.

No baseline parameters were established for this study by OEO management, allowing maximum freedom to seek effective responses. To focus the effort, however, the following five parameters were laid down by the lead researcher:

1. Determine whether available research had been done into extreme risk issues of dependability vice suitability aspects.

2. Determine feasibility of development of a flexible scale for personnel selection using standard testing and evaluation mechanisms.

3. Assume the HRP structure developed would have to serve selection against multiple extreme risk scenarios simultaneously, and provide assurance of continuing suitability and capability in each or all.

4. Determine feasibility of development and application of standardized testing methods and flexible evaluation criteria to a broad population and multiple cultures in a single PRP-type program.

5. Collect and integrate existing suitability PRP data.

To these parameters the Director, OEO, added the following during an IPR on March 18, 1991:

Determine how to:
- Implement a modular HRP;
- Implement with other organizations outside OEO;
- Develop models;
- Develop selection criteria.

Determine what:
- Criteria to use with different populations;
- Type of development personnel are needed;
- Categories (modules) would be used by populations;
- We're trying specifically to protect.

B. STUDY DESIGN AND EXECUTION

This study was intended to support development of practical applications for findings as soon as possible should a decision be made to proceed. The means chosen to effect this purpose were through use of a multi-faceted approach that would allow maximum data retrieval in a limited time. The information would then be subjected to an integrational analysis and means and models developed to meet baseline requirements. All findings would have to pass the tests of applicability, capability, and necessity for use in multiscenario EREs.

The accomplishment of the task as set forth above is made no easier by an examination of various classified threat documents, as they are often far better at defining what is expected to be lost than what might survive. Additionally, the Murphy Law of Combat that no OPLAN (operations plan) survives first contact can be expected in any ERE to be absolute, whether or not actual combat is involved.

The areas of information to be concentrated upon in this effort were those aspects of reliability selection dealing with behavior, psychology, physiology, performance, and monitoring. The reason for focusing on these areas is that they are the least standardized across the Federal Government, and because most other parts of the review and selection process are clearly defined, validated in

extensive and continuing testing, and mandated by National authority: these constitute investigative requirements and the investigative and adjudicative processes. Further, some agencies currently have reliability selection and retention procedures in place in their organizations, although their practitioners freely admit that such procedures are unsuited to selection to meet EREs.

Having defined areas of information to focus collection efforts upon, it was determined by the lead researcher to proceed simultaneously along several tracks:

1. Collect current PRP regulations for background material.

2. Form a research team to develop information and help analyze it.

3. Conduct extensive interviews with personnel currently running or working upon design aspects of HRP's.

4. Conduct full-scale national database checks to identify relevant research material.

5. Obtain and review relevant academic information.

C. REGULATIONS

As a first step, DOD and each of the services were asked for copies of their PRP regulations. All responded except the Navy, who advised that their manual was currently in revision. It has remained so throughout the course of this study, due to negotiations between DOD and Navy regarding what are seen as policy or perceptual issues, depending on agency orientation. The Army and Air Force regulations are of course service-specific implementation policies of the DOD policy.

D. RESEARCH TEAM

A research support team was formed to identify and obtain human and record sources of information, and provide professional technical assistance. The latter capacity was filled initially by Dr. Michael Wigglesworth of the National Security Agency (NSA), who volunteered the assistance. Later on, Dr. Richard Rees of the Central Intelligence Agency (CIA) was essentially co-opted for a similar purpose on an infrequent basis. Their involvement was in providing advice regarding human sources, directions and related issues to examine, and in responding to specific questions developed from this research. U.S. Army Military Intelligence was enlisted to help identify human and record sources, and they eventually identified the bulk of people

interviewed during this study. In addition to leads they assigned field agents like S/A Brenno, S/A Parker and S/A Clawson attempted to develop sources of record and human information on their own. S/A Lee Anklin assisted with analysis of collection efforts at one point. The team leader/lead researcher assigned from the Office of Emergency Operations was Richard Nelson, who also prepared this study.

E. INTERVIEWS

Despite a significant academic effort made for this study, the core of it was intentionally a series of interviews with professionals involved with PRP's or similar programs, or with the study of aspects of human reliability. This course was chosen to maximize professional input, given the limited time available for this study. A standardized interview format was developed to assure all applicable areas were covered; this was later modified twice to provide guides for certain special purpose interviews. Interview formats are contained in Appendix B (attached). Virtually all interviews were conducted by Richard Nelson. In practice, most persons interviewed had proposed discussion formats or presentations (sometimes with material) that they wished to follow initially, and Mr. Nelson willingly accepted this approach as it gave fuller perspectives of the interviewees' understanding and positions. Any issue areas in the formatted interview not covered incidentally earlier were pursued after the interviewees completed their presentations when such a process was used. Interviewees often covered half or more of the formatted items unwittingly in the earlier portion of the interview. Other interviewees followed the formatted questions, which allowed focused responses in minimal time. An extensive amount of valuable--and even more importantly, practical--information was thus gathered in this manner from professionals in a variety of communities including clinical (behavioral) and industrial/organizational (I/O) psychology, psychiatry, from medical service officers, and other authorities.

The interviewees made a number of general and specific suggestions and recommendations, which will be cited at appropriate points. All expressing an opinion were highly supportive of undertaking research in the areas identified for this study, though a number expressed dismay at being told an unclassified version might not be done, or that no action might be taken on the classified report if any.

R E C O M M E N D A T I O N

Compile an unclassified version of this study whether or not a classified version is done.

The Director, OEO, verbally authorized the development of an unclassified version of this report on July 16, 1991.

F. ABSTRACT SERVICES

A variety of National-scale databases were used in this study to help identify pertinent material in related areas. These databases operate by use of key word/phrase identification association. Interviewees also made a number of valuable suggestions that assisted in developing relevant information, to include categories of information to pursue in the abstract services, areas that would be unproductive, and locations and accessibility of abstract services. Preliminary foci for research into pertinent, more closely related information were research on the Israeli Defense Forces (IDF) psychological literature (suggested by Ginzburg and Rees), nuclear related psychological issues (Reardon and Ginzburg), police/forensic psychology (Rees and Kurke), and aerospace medicine (Fiedler, Patterson, and Sipes). The lead researcher conducted extensive research in the NEXIS, National Technical Information Service (NTIS), and Medline databases himself, and was capably supported in searching and acquiring information from the Defense Technical Information Center (DTIC) database by Reference Librarians Dewey Goff of Strughold Aeromedical Library, USAF School of Aerospace Medicine, and Lorna Dodt of the Pentagon Library. Ms. Dodt also had an extensive check made of the Psychological Database through the DIALOG service for the lead researcher.

A more general but unifying area became predominant as the abstract services were checked: the critical relationship of various aspects of stress to human suitability and performance reliability. This in turn became one of the underlying factors studied in this report.

G. INFORMATION SOURCES

In addition to expert interviews and abstract services a number of libraries were checked to obtain previously identified and new material: all provided at least some information valuable to this study. They included the National Library of Medicine (NLM) and Pentagon libraries in Washington, D.C.; Strughold Aeronautical and Human Resources Libraries in San Antonio, Texas; and the U.S. Naval Hospital Library in San Diego, California. Regretfully, time pressures made it impossible to check other libraries that appear likely to contain pertinent information, such as the Air War College Library in Montgomery, Alabama.

A selection of other valuable information often not identifiable through abstracts or available through libraries was provided by the interviewees and others:

Dr. Ginzburg - copies of classified and coauthored unclassified research papers (including one not yet released at the time);

Dr. Rees - results of classified internal CIA research;

Federal Bureau of Investigation - Psychological Services for Law Enforcement Symposium compilation;

Dr. Kurke - original and modified models of human reliability in an I/O context;

Dr. Fiedler - Air Force Military Evaluation Test (AFMET) program and validation testing, co-authored research papers;

Pat Dowd - copy of William Archer Jones, Jr.'s thesis on Evaluation of Voice Stress Analysis Techniques in a Simulated AWACS Environment;

Dr. Sipes - copies of the U.S. Army's GTA 21-3-4, 5, and 6 dealing with battle fatigue issues at the troop, troop leader, and company commander levels;

Dr. Crawford - copies of numerous unclassified co-authored PERSEREC studies, a compilation review for the Defense Nuclear Agency, and a Personnel Decision Research Institute study of investigative interviews;

Dr. Wiskoff - coauthored research papers and a copy of an incomplete personnel security databased interview format on floppy disk;

Dr. Chapman - copy of Osterkeamp and Press' book Stress? Find Your Balance;

Robert Oppenheimer - background material and history concerning an earlier classified effort on a subject related to this study undertaken by another organization;

Dr. Gerwell - copies of pertinent textual materials;

A number of classified and unclassified manuals, regulations, and other guidance from a variety of Federal military and civilian sources was also consulted during this study. They are listed in the references.

Section III. Stress and Human Reliability

A. INTRODUCTION

Given the wide range of experience, training, education, and viewpoints of those who will read this report, a general background of stress-related issues and their relationship to EREs has been provided in this section in order to offer both a somewhat more level field for commentary and an identification of some of the conceptual difficulties underlying genuine operational needs. It is not intended to be all inclusive.

B. BACKGROUND ISSUES: STRESS AND RELIABILITY CONCEPTUALIZATION

For a topic that has given employment and investigative purpose to entire disciplines for ninety years, stress remains a curiously elusive subject. A large body of literature exists concerning various aspects of stress and responses to it, but as Barge, Hough, and Dunnette (1984) point out, "the concept appears to be defined in whatever way happens to fit the particular investigator's framework rather than by reference to any ongoing explication of the concept."

Despite conceptual murkiness however, stress has long been linked to reliability--and not always unfavorably. As demonstrated by the Yerkes-Dodson Law (1908), to a point stress is necessary to obtain optimal performance, after which stress degrades performance. This law can be conceptualized by the familiar bell shaped curve, with vertical stress and horizontal reliability axes. Things become more problematic beyond the position of the curve in a given individual at a given place and time with a given stressor, however.

In the absence of a common definition for stress, Barge et al (1984) choose to identify indices currently used in stress research. The indices fall into three categories: behavioral, psychological, and physiological, for which they list characteristic behaviors or symptoms of stress. These are cataloged below:

Behavioral Indices of Stress

performance inefficiency	psychopathy
errors/accidents	self-destructive behavior
target (non)detection	sleeping disturbances
reduced productivity	suicide
reduced job involvement	deterioration of relationships
unreliability	drug use

absenteeism
attrition
withdrawal
sabotage
alcohol use
hypervigilance
impaired decision-making

Psychological Indices of Stress

job tension
boredom
depression
irritability
anxiety
resentment
neuroticism
(lack of)self-confidence
(lack of)self-esteem
burnout
job-related threat to well-being
job (dis)satisfaction
apathy
fatigue
frustration
guilt
absence
temper
moodiness
loneliness

Physiological Indices of Stress

headaches
digestive difficulties
hyperuricemia
gout
rheumatic disease
dermatological symptoms
diabetes
ulcers
respiratory ailments
skin conductance
respiratory rate
respiratory rate
hypertension
blood pressure
heart rate
eliminative function difficulties
coronary heart disease
brain waves
serum lipids
free fatty acids
serum cholesterol
adrenaline
noradrenaline
serum glucose
cortisol
amino acids
corticosteroids
prolactin
thyrotropin
growth hormone
myocardial infarction

(after Barge, et al)

Thus they define the concept and problem of stress by citing its symptoms as an interaction between the person and the environment. Their list is not, nor is it intended to be, all inclusive. For example, one source adds trembling, restriction and narrowing of the perceptive field, longer reaction time to peripheral use and decreased vigilance, performance rigidity, and lowered immunity to disease (Driskell et al, 1990). Yet another source (Stephens, 1987) takes a somewhat different approach by defining stress as a state of imbalance, reflecting the unrelieved dominance of either arousal or inhibition, which is applied to behavioral, psychological, and physiological reactions to the environment. Stephens quotes Holmes and Rahe (1967) that "we caused tissue damage by just talking about a

mother-in-law coming to visit" to demonstrate potential sensitivity in furthering his argument that the unrelieved arousal must be perceived as distressing. A physiological definition of the concept of stress might vary in a number of important aspects however, e.g., its definition as the physiological consequences of a threat (Herd, 1991). Indeed, Benson et al (1977), citing the predictability of human reaction to a stressor by involuntary activation of the fight-or-flight response concur that excessive or inappropriate arousal of the fight-or-flight response may increase pathogen or health disorders.

The literature also abounds with models of aspects or perceptions of the person/environment stress relationship, all appearing substantially valid for their purposes, but often with little or no resemblance to each other. They thus serve as additional clarification of the difficulty of harnessing the concept.

Despite divergences of opinion or perception, an increasingly unifying trend in the literature is to view stress as the product of an interaction between the (individual) and the environment (Keinan, 1986). This tendency was also reflected in the great majority of expert opinions obtained for this report.

C. HUMAN STRESS IN EXTREME RISK ENVIRONMENTS

In the narrower field of human reliability under the stress of EREs offering a distinct possibility of death or serious injury, there is somewhat more substantial unanimity regarding disabling stress impact upon participants in combat environments (Rahe, 1988), although Barge et al (1984) found conflicting evidence regarding increased stress or negative effect in dangerous situations based on a review of studies of dangerous military and civilian environments. It appears however that Barge et al formed their opinion based upon review of literature focused more upon review of predominantly physiological aspects and self-reporting of psychological aspects. The two combat examples they present of multiple loading/non-firing of rifles at the Battle of Gettysburg (from Waller & Burkhardt, 1965) and weapons firings by only the same fifteen to thirty percent of troops engaged in World War II units (from Marshall, 1944; 1947) are simultaneously consistent with perceptions of increased stress in combat and more ambiguous due to unanswered questions concerning organizational and environmental aspects. That there is also very little data available regarding reliability in emergency situations due to their being low probability events is agreed upon both by literature (AGARD, 1989) and the great majority of experts interviewed for this study. There is a significant body of information available in the areas of reaction to combat environments and coping with those environments. In fact, as stated by Novaco, Cook, and Sarasan (1986), "the study of

human stress has not a better context for investigation than in military environments." They base this opinion upon two cited factors: the harsh physical circumstances that affect tissue needs, and the threatening psychological ambience of combat.

Stress casualty rates in combat are exceptionally high in comparison to other types of losses. During World War II, one example cites stress losses at 50+ men per day (10% of effectives per month) for U.S. Army Divisions (Driskell et al, 1990), another at 18-48% of all casualties sustained (Mandelbaum, 1954). During the 1967 Arab-Israeli War, the Egyptians were said to have suffered stress casualties three times higher than wounded in action, and the Israelis 900 of the first 1,600 during the 1973 war (Labuc, 1984). Over the course of the entire 1973 war, the Israelis were reported to have suffered psychiatrically-related casualties amounting to 23% of all non-fatal casualties (Belenky, Tyner, and Sodetz, 1983). Currently, U.S. experts predict stress loss rates at 25% of all casualties for conventional war and 50% or higher for nuclear or chemical warfare (Driskell et al, 1990), or at one in every three to five wounded in combat (GTA 21-3-6, 1986).

Such losses can extend beyond combat itself, too: only one percent of German held POW's died before release in World War II, while 33% of Japanese held POW's did. Based on an analysis of similar factors, it has been concluded that the difference was the greater stress of Japanese captivity (Wolf, 1950).

Categorization of Post Traumatic Stress Disorder (PTSD) in DSM-III-R cites overwhelming natural, manmade, or personal disasters such as tornados, combat, or rape--experiences well outside the normal human experience--as being likely producers of severe stress reaction. There is a substantial and relatively homogeneous literature concerning military aspects available, and a literature regarding natural disasters is being built. Currently the latter is having to deal with a high level of controversy (Steinglass and Gerrity, 1990). Some very broad themes appear to be relatively consistent between the combat and disaster related literature, though: stress rates are comparatively high, many suffer some or most of the symptoms, substantial attenuation can occur with increasing time after threat termination, and most persons exposed don't suffer combat stress reaction (CSR) or PTSD symptoms at levels sufficiently high to warrant treatment (Rahe, 1988; Steinglass and Gerrity, 1990; GTA 21-3-6, 1986).

D. DECISION MAKING IN EXTREME RISK ENVIRONMENTS

Decision making is a complex process under any circumstances. It has been defined in a number of ways, for example as analysis surrounding a psychological moment of choice (Pitz and Sachs, 1984; Berkeley and Humphries,

1982); as a complex task depending on a number of separate cognitive abilities that are themselves multifaceted (Wickens et al, AGARD-CP-2/58, 1988); or as a continuum between recognizable and analytical decision strategies (Klein and Thordsen, 1989).

An ERE that offers genuine possibility of death or serious injury presents the greatest challenge to effective decision making due to the consequences of an error. Often on such occasions, however, time and circumstances conspire to provide the least effective opportunity to make accurate decisions. This does not necessarily mean that decision making quality is degraded, though. A common thread in Wickens et al and Klein and Thordsen is that using what the latter call a recognizable strategy for decision making allows experienced decision makers to arrive at effective choices with minimal analysis. This holds true both for time effects (Klein and Thordsen, 1989) and circumstances (Wickens et al, 1988). Both note the need for higher degrees of analytical reasoning on the part of less experienced persons, who are thus more vulnerable to stress effects, and both note the degrading effects on decision making from increases in spatial requirements. Wickens et al also warn however that experienced decision makers tend more towards overconfidence, resulting in additional risk and less reliance on memory. Keinan (1986) also relates confidence to experience level, but feels it did not derive exclusively from direct experience with risk, and noted the impact of time stress on peripheral tasks (a factor also cited by multiple interviewees during this study).

For experienced decision makers, cognitive failure due to overarousal or underarousal is cited by Wickens et al (1988) as being the most consistent immediate cause of accidents. Cognitive skills are also more prone to degradation than labor intensive ones (Driskell et al, 1990). Factors affecting task performance are shown in Exhibit 1 (Driskell et al, 1990) and leading to casualty-producing accidents in Exhibit 2 (Kurke, 1991).

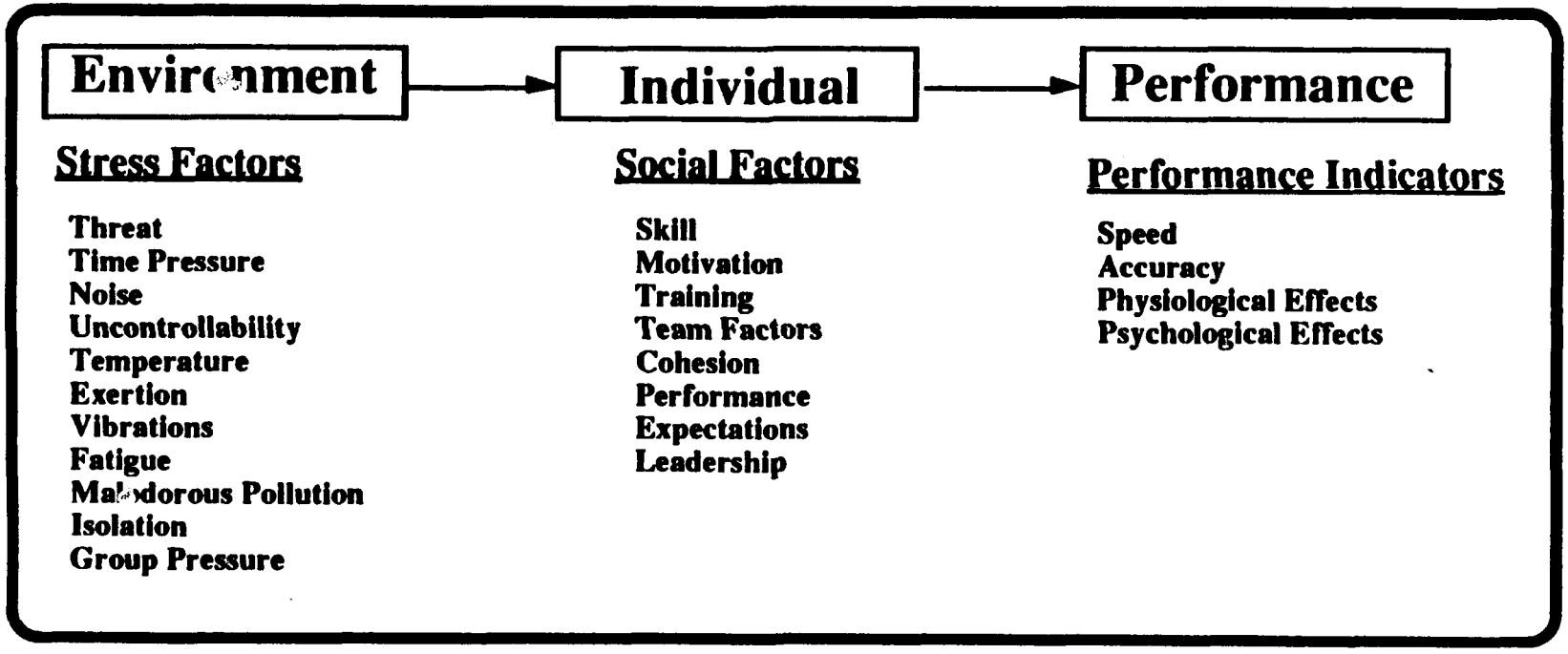

Figure 1
Model of Stress and Performance
(from Driskell et al, 1990)

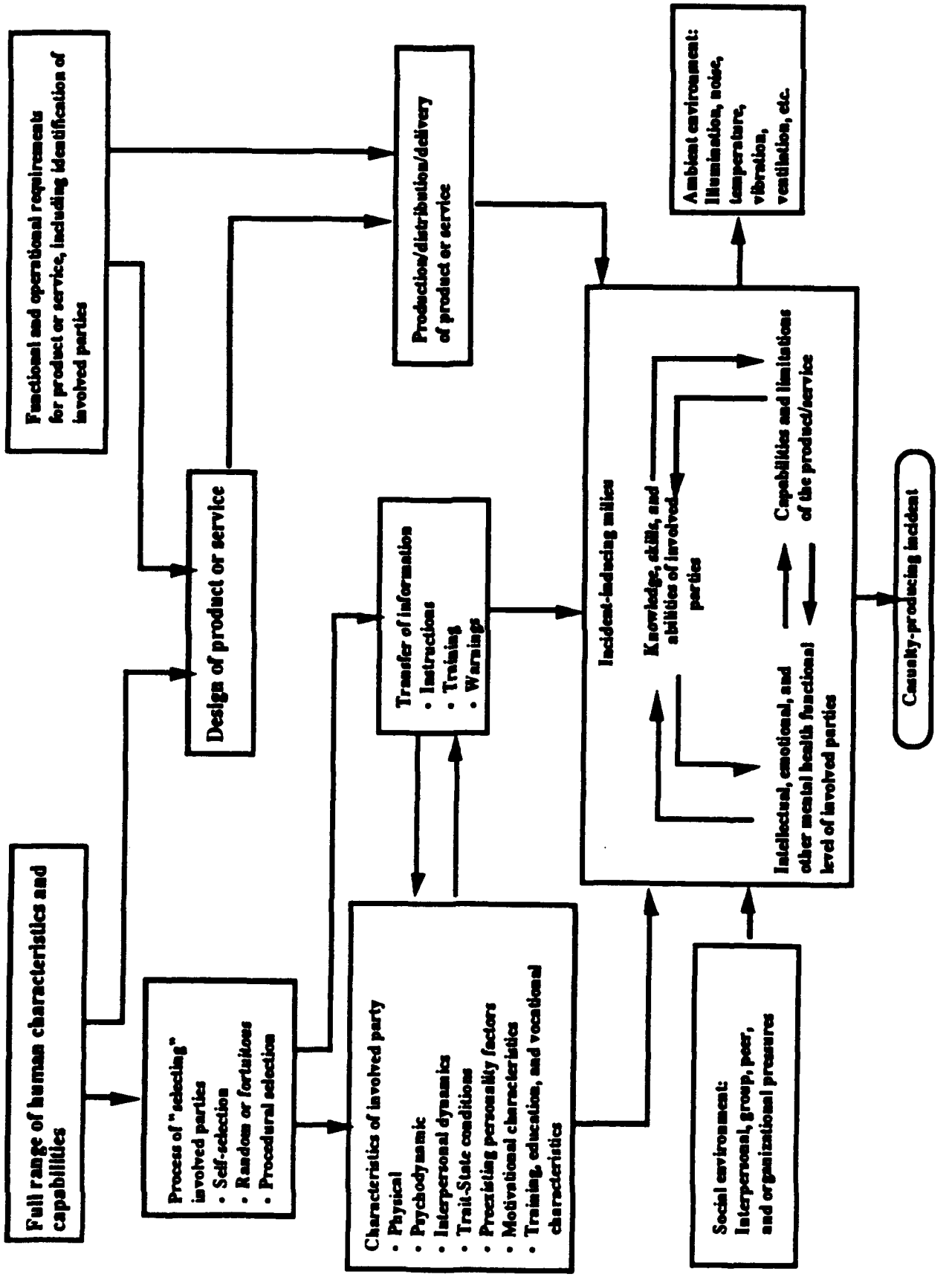

Figure 2 Precursors to personal injury. (M. Kurke)

E. TEAM DECISION RELATED ISSUES AND STRESS

Stress leads to more reliance on recognizable decision making strategies versus analytical ones in teams as well as individuals (Klein and Thordsen, 1989). Perhaps surprisingly, the presence of other team members tends to degrade rather than enhance individual performance (Driskell et al, 1990): even a two man team experiences a small effect, three a moderate to large effect, and larger teams a very large effect. Not as surprising, team leadership can also exercise a significant impact, with negative leadership affecting both team efficiency and error rate (Chidester and Foushee, 1988). Another source has identified eight other potential problem areas for team decision making as well: 1) distorted perception; 2) difficulties with situation assessment handoff; 3) difficulties in the formulation or transmission of intention; 4) directed attention; 5) missing expectancies; 6) restricted improvisation; 7) synchronization; and 8) metacognition (Klein and Thordsen, 1989). Additionally, Dr. Fiedler when interviewed by the lead researcher for this study cited the importance in a training environment of quickly isolating problem personnel to prevent additional losses due to emotional contagion.

F. COHESION AND INFRASTRUCTURE

Despite adverse effects on group and individual decision making, there is often no other way to effectively accomplish a task than by use of a team approach, and individual performances can be enhanced by team participation, as can be observed from team sports. Why is less certain. One study (Zakay et al, 1986) that tested cognitive and motor tasks under heat stress suggests that stress reduction observed was due to co-actor participation in the task they all, by experience, knew what the individual members were experiencing. This is borne out anecdotally by Dr. Fiedler and John Reardon. Reardon warns however of the importance of maintaining a functionally operative infrastructure. He cites as examples of relatively effective group performances in a civil disaster the responses of civilian emergency and local military assets to the San Francisco earthquake of October, 1989. Steinglass and Gerrity (1990) suggest in their study that the town's perception of a flood in Parsons, West Virginia in 1985 as a community-wide disaster led to more effective stress coping as well despite weak infrastructure, but Reardon also cites the 1972 Willsboro, Pennsylvania flood as one in which the effects of the disaster were magnified by abdication of surviving local leadership. Steinglass and Gerrity (1990) suspect that good infrastructure was sufficient to prevent a relatively higher proportion of PTSD casualties as compared to Parsons, West Virginia in a

community devastated by tornado (Albion, Pennsylvania), which they suggest was due to a perceptual division on the parts of survivors into victim and non-victim categories.

Military literature is more uniform in stressing that cohesion of military units in combat is crucial to effective or continued performance and casualty minimization. This is true in nuclear (Mickley, 1989) and other types of combat (Rahe, 1988; GTA 21-3-4, 1986; GTA 21-3-5, 1986; GTA 21-3-6, 1986) as well as for prisoners of war (Rahe, 1988).

G. COPING IN EXTREME RISK ENVIRONMENTS

Perhaps not surprisingly given the controversy over the concept of stress itself, coping responses appear to be an issue of little less controversy than their precipitators. A wide variety of perceptions on the parts of both researchers and subjects affects this, but there is also some general agreement on theoretical approaches to the issue of coping strategies: psychodynamic, person-environment/relational, and individual difference views. The psychodynamic theory essentially postulates that coping is a defense-oriented tension reduction process responding to intrapsychic conflict; the person-environment/relational that coping aims at cognitive and behavioral strategies to alter a stressful transaction; and individual differences on fluid, multi-dimensional variables surrounding locus of control aspects. Foci of coping processes are seen as being either emotion (internal control) or problem (external adaptive) oriented (Barge et al, 1984).

Appropriate coping strategies are obviously critical in an ERE. Dr. Fiedler reported that in highly stressed communities she dealt with, stressors were the same for those who succeeded and those who didn't--only the coping and social net capabilities varied: Dr. Chapman, referring to a similar population, agreed. Both Dr. Fiedler and Dr. Gerwell (1990) feel that how individuals are prepared for stressors is as important as individual adaptiveness. They use short term intervention--group sessions--to enhance coping skills. Elsewhere, (1990) they cite a high stress community whose members required more significant intervention perceived themselves to have many fewer personal resources; for this effort the Occupational Stress Inventory (OSI) was used to measure stress factors and levels. Dr. Glogower in interview also noted the value in high risk environment personnel selection of measuring coping skills to determine an individual's use of constructive or destructive coping strategies.

Coping in EREs obviously must be both effective and constructive in order to better assure both immediate survival and continued functional performance of an individual. Training is only a partially effective means to both teach personnel constructive coping techniques and

inure them to stressors that require use of the techniques, since in many cases it is impossible to train realistically enough to cope with real-life challenges or to cover all specific situations that may need to be dealt with by coping. Some EREs might be sufficiently alien to direct experience that new coping mechanisms might need to be developed and utilized. Finally, the particular circumstances of a specific environment might require use of either new or previously used coping mechanisms in ways different from those learned or utilized before in order to respond to situations radically different from those experienced before, with varying lead times between employment of a particular coping response and its consequences. Intensity can also vary. For example, as GTA 21-3-4 (1986) states bluntly, war is more stressful than any training can be, but as Mickley (1989) adds, nuclear detonations can produce such devastation as to create a perceived unreality of the aftermath. And underlying the great majority of research into coping is the fact that it is generally of pathogenic orientation (Antonovsky and Bernstein, 1986).

Despite the novelty and extremity of circumstances, significant numbers of personnel do appear to adapt more or less successfully to EREs. Steinglass and Gerrity (1990) noted the striking resilience of most people in their study of tornado and flood victims in two communities and percentages of personnel not lost to stress in combat environments can be identified from statistics cited earlier in this study. Substantial research has been done into measures to prevent PTSD and enhance coping, the most significant measure being reported as development of a sense of pace (Rahe, 1988); this is also implicit in Milgram's (1986) comparison of successful coping techniques by prisoners (Shachak and Weir) of different Middle Eastern interests: both apparently structured and compartmented their activities, then dealt with each compartment separately. This is rather similar to Dr. Kurke's advice regarding the approach to the interrelated core issues of this study. Similarly, though Mickley (1989) warns of evidence of direct influence on psychological changes by ionizing radiation (leading to more compliant, subdued behavior, depressed motivation, and attentional focusing), he also notes that most victims of the Hiroshima and Nagasaki bombings "behaved in a manner compatible with established social norms" (p. 160), nor was there increased incidence of psychosis.

H. INTERPERSONAL CONFLICT

One of the most serious threats to security and operations within EREs might be interpersonal stress among the members of the group or team. Research into isolated microsocieties (Warren, 1988; Helmreich, 1987; Evans et

al, 1987; Emurian and Brady, 1981; Gunderson, 1966) strongly suggests that even in highly professional confined populations, there is a serious potential for significant interpersonal conflict to develop. Indeed, Warren (1988) cites disruptive effects in all of four separate tests using professionals isolated for only four to seven days in a comparatively luxurious habitat complete with recreation room featuring stereo, television, and gymnasium; both he and Helmreich (1987) cite similar problems in both the United States and Soviet space programs among astronauts/cosmonauts, including (Helmreich, 1987) a "mutiny" on board the U.S. Skylab. Warren (1988) and Dr. Glogower in interview also cited interpersonal conflict resulting from the isolation of wintering-over in the Antarctic. The Federal Emergency Management Agency (FEMA) recognizes the interpersonal conflict potential in Civil Defense shelters as well (CGP 2-21 of May 1988).

Interpersonal conflict arises from a very large number of specific potential sources, but in most general terms from stress produced by the nature of the environment and/or habitat time (Warren, 1988; Gunderson, 1966), and individual unsuitability for adaptation to the conditions experienced (Evans et al, 1987; Helmreich, 1987; Gunderson, 1966). Warren (1988) also notes the strong possibility of greater discord in mixed gender populations, though stressing the need for more research in this area.

Factors mitigating interpersonal conflict include leadership (Warren, 1988; Gunderson, 1966); compatibility/cooperation (Evans et al, 1987; Emurian and Brady, 1981; Gunderson, 1966); emotional control (Warren, 1988); work role/performance (Warren, 1988; Helmreich, 1987; Emurian and Brady, 1981; Gunderson, 1966); and likability (Warren, 1988). The chief means of avoiding interpersonal conflict other than modification of the living and work environment is by personnel selection (Warren, 1988).

I. PERSONNEL SELECTION AND MONITORING

For purposes of this study, personnel selection for EREs will touch upon (1) behavioral, (2) performance, (3) physiological, and (4) psychological issues. These are seen as primary fields of interest in such environments.

1. Behavioral Issues

Behavioral aspects of personnel selection have been exhaustively researched, yet remain a significant area of controversy. As has been stated, the axiom that past behavior is the best predictor or future behavior is so commonly observed in everyday life that it's difficult to conceive of a situation in which predictive behavior had no prior analogue. Perhaps the most comprehensive approach to

the issue is taken by the same source in suggesting a selection, monitoring, and interaction approach based on personality characteristics, vocational interests, and biodata in an interaction with environmental characteristics, life events, stress, coping, and target behaviors (Barge et al, 1984).

2. Performance Issues

It is a precept of this work that personnel should not merely survive but be able to function in an ERE. Yet as might be expected, stress degraded performance is most likely when least tolerable (Driskell et al, 1990). Stress-induced performance degradation even in an ERE is not uniform, however: one study observes that knowledge skills are not degraded by stress (Wickens et al, 1989), another that cognitive skills are degraded by stress more than labor-intensive ones (Driskell et al, 1990). Another factor may be critical as well in some EREs: as Driskell et al (1990) have observed in a military context, the person-machine system is the fundamental military unit, but in combat systems, so much has been done to improve reliability and effectiveness that the most unpredictable elements are human operators (Trejo et al, 1987).

Regardless of context though, it appears that a high confidence expectancy engendered by experience can mitigate psychological stress sufficiently to allow effective performance even in the face of extreme risk (Keinan, 1986). Ursin (1989) essentially agrees, noting also that such a state need not cause high levels of endocrine or autonomic reaction if the individual expects a positive outcome. Dr. Sipes, in interview, also held that performance should focus on stress resistance enhancement vice merely coping.

3. Physiological Issues

The requirement for a person to be physically capable of performing necessary duties, particularly in an ERE, is obvious. Physical fitness, especially endurance related, may be helpful in enduring psychological stress (Rahe, 1988), but it is not necessarily a factor: Herd (1991) cites numerous studies showing cardiovascular reactivity to stress had no consistent relation to exercise conditioning or physical working capacity. Indeed, he cites family history as the most significant modifier of psychological stressors.

4. Psychological Issues

Psychological factors are of critical significance in EREs not only because of issues cited earlier in this study impacting on reliability, but because of the cumulative effects stress can produce in such an environment (Novaco et al, 1983; Mickley, 1984). The basic element of

psychological consideration is personality, which is characterized by traits (Anderson, 1989; Barge et al, 1984). This study deals less with traits than might be expected however because although traits can be an important factor in selection of personnel for certain types of high risk environments or EREs, and though traits can and have been measured effectively both quantitatively and qualitatively (Anderson, 1989), selection methods involving traits must be very carefully constructed, as perception of needs can vary somewhat from results obtained. For example, the U.S. Army looks for resourcefulness, ingenuity, pragmatism, patience, self discipline, dependability, and emotional stability in its Special Forces personnel; in testing, they found the most successful candidates were low anxiety, high persistence, high vigor, risk takers (Pleban et al, 1989). An experienced combat pilot identified traits of an ideal combat pilot as being leadership, masculine/adventuresome, intelligence, stability, extroverted, archly humorous, and patriotic (Spiller, 1989); a number of psychologists and psychiatrists at the same conference (AGARD, 1988) cited Type A behavior patterns (Damos, 1988), self-confidence (Barnes and Lurie, 1988; Siem, 1988), and a complex defense mechanism (D. R. Jones, (1982), cited by Barnes and Lurie). The same characteristics and mechanisms that made them successful also were cited in cases of high or extreme risk to have potential to cause illness or emotional problems (Barnes and Lurie, 1988), or overconfidence (Wickens et al, 1988), while Chappelow (1988) argued that under-arousal was a very significant accident factor. The variations in concept and focus at the AGARD Conference led one observer (Billings) to note the contradictions presented, those other contradictions presented by military and civil air transport pilots (opposite characteristics in the same person needed in different jobs), and the inability to select accurately based on traits. Earlier he (Billings) had noted low correlations in trait measurements as the reason they were no longer used. Another observer/participant (Ursin) in response stated that it was important to be very accurate in what was to be predicted if traits were to be used. It could be noted that since Desert Storm, there would probably be some reaction to the pilot's requirement for masculine traits, too.

The points are that traits are extremely difficult to use in a selection process and that those necessary may vary depending upon the type of ERE: for example, research into isolated, confined environments (ICE's) suggest that compatibility and stability of groups in such environments increases with homogeneity in lack of need for prominence (Gunderson, 1972; Nelson, 1964; Nelson, 1964). Barge et al (1984) also note that "personality measures seem to have their greatest predictive power when applied to adjustment criteria, those same criteria that are most important for the reliability of behavior." (p. 10)

5. Monitoring Issues

The problem with a selection process without continuous monitoring is that it provides only a "snapshot" of an individual, as Dr. Glogower expressed in interview. Monitoring programs focus on detection of unsuitable or unreliable behavior or indicators of them vice prediction of such behaviors, as done by selection. Thus monitoring can compensate for two failings of selection: inaccurate prediction and behavioral change (Barge et al, 1984). The values of monitoring are generally agreed, but there are a number of alternative means to accomplish such programs. For example, Bosshardt et al (1991) and Barge et al (1984) tend to focus on commander/supervisor responsibilities; the U.S. Navy stresses that all personnel have responsibilities to report unusual behavior by any others in the PRP; Dr. Rees suggests use of the informal net of psychological and psychiatric personnel as trained observers, and the U.S. Army requires a surety board, officers, and coordinators (AR 50-5, 1989). Scope of monitoring effort, specific procedures utilized in monitoring, training level of reporters, and frequency of review are subject to similar variation.

J. IMPLICATIONS OF EXTREME STRESS ENVIRONMENTS ON OPERATIONAL PERSONNEL

With very little doubt, stressors of all kinds would be imposed upon operational personnel in the event of an ERE of any scale, whether the personally devastating losses or threat of losses that might be experienced by an individual or the massive cataclysmic devastation by natural or human means of a large area or the whole nation, that should in many cases be expected to exceed anything in their direct experience. Some types of devastation, such as wide scale geological, biological, nuclear, atmospheric, chemical, or other type of invasive disruption may in fact exceed effective conception by participants that might be required to respond effectively to the effects experienced, both on a personal and a much wider scale. It is likely that personnel would have to deal simultaneously with a variety of threats at multiple levels in an extreme stress environment. As can be seen from preceding material regarding extreme stress and human reliability, however, although the challenge is daunting, if personnel can survive the event with means to carry out their duties at some level of effectiveness, they can function to mitigate effects of the event. As it is known that personnel can survive and function, in extreme risk events, it is possible to construct mechanisms for identifying best-risk and worst-risk candidates for assignment to deal with such events. It also appears that it would be possible to establish specific criteria for the particular requirements

of teams, organizations, and activities that directly or indirectly support operations in such environments. Unless a reliability program is established to select personnel who can meet suitability (often security-oriented) requirements and function, even if isolated, in EREs however, the preceding information in this section also strongly suggests that elements deployed to deal with such events will suffer stress casualties in sufficient numbers to render them at best ineffective and at worst eliminated. In many cases, deployed elements aren't the only personnel who should be included in an HRP, however.

It would be most desirable to establish an HRP for all personnel directly and (at least as far as direct support to directly involved elements is concerned) indirectly involved in operations in EREs. The selection process thus would be enhanced by providing a mechanism beyond current means for most such populations that would assure a higher degree of reliability in personnel at selection, throughout their association, and to some degree after separation. It would also assure that acceptable replacements were more readily available to fill in for anticipated losses. The scope of effort that such a system might require could be substantial if multiple planning, response, and/or support activities are to be covered. For reasons of cost, though, populations indirectly involved in responding to EREs might not necessarily be screened in an HRP as rigorously as those directly involved, but again for cost effectiveness, the screening mechanism(s) used should be directly and rapidly expandable to full scale. It would also appear that at least low-level HRP criteria could be developed for application across multiple populations.

Use of an HRP could also ensure selection and retention of emotionally hardier staff personnel who also have better morale and unit cohesion (these desirable features may be built into the selection procedure). Focus on performance under stress could significantly reduce stress losses.

An added consideration is that in particular extreme risk scenarios it may be necessary for directly and/or indirectly involved personnel to present an outward appearance of normalcy to minimize the disruption and panic that might otherwise ensue. Such conditions may well require striking a balance between providing too much or too little information to others at a given time where either could result in the same magnified undesirable effects. An HRP for EREs must be sensitive to this potential requirement.

An HRP can also provide more general, non-emergency enhancement for activities dealing with EREs by increasing selection and retention capability for people with better abilities to deal with performance and security related issues before they become crises. Hardening of such activities would be provided operationally or during periods of quiescence through increased reliability and functionality of personnel under stress. This translates directly into increased mission capability.

It is recognized that it may be necessary to consider trade-offs in selection between quality of one individual's performance in peace or quiescent times and that of another who has better performance under stress. In such events, it is critical to examine the specific scope and nature of scenarios a population selected to deal with them might face in order to effectively analyze the extent of trade-off that would not compromise mission accomplishment. A number of other factors may impact as well: for example, security standards may or may not be able to be relaxed in order to more readily permit mission accomplishment while still maintaining necessary protection for the mission, and if they may be relaxed, they may be able to only at some stages and not others. Some performance degradation should be expected from the best personnel in an actual ERE, but functionality must be retained. Overall, suitability to accomplish the mission is the baseline requirement.

Section IV. Behavioral Reliability Issues in Extreme Risk Environment Contexts

A. INTRODUCTION

As could be seen from the previous section, the issue of behavioral reliability is a complex one now generally seen to involve an interaction of the person with his/her environment. The issue basically devolves though to the individual's suitability for assignment in a particular position and environment. Suitability determination in the Federal defense, intelligence, and security communities is a matter of personnel security adjudication based upon a mandated scope investigation and at the most sensitive levels utilizing selection requirements in Director of Central Intelligence Directive (DCID) 1/14.

B. CURRENT POSITION

Certain agencies in the Federal Government such as the Central Intelligence Agency (CIA) and the National Security Agency (NSA) employ psychological services and polygraph, whose primary purpose is, as psychological review is in DOD PRP's, to reinforce the suitability selection process for the agency as a whole. According to interviewees, both agencies cited above employ at least in part currently available commercial psychological testing instruments. Instrument selection and application at CIA and NSA is made to enhance the general selection process in use at the using agency and is different for each. Interviewees at both agencies however noted that their processes are aimed at other criteria than those identified in this text, and would be unsuited to application to populations in EREs.

The issue of polygraph use is a highly divisive one. Defenders such as Dr. Rees of CIA feel that although polygraph is known to fail to obtain all available data, information from lifestyle polygraphs is more faithful to the whole person approach. The issue is not just a failure of intentional self-reporting: as cited by the NSA psychological staff, honesty with self is essential to psychological testing, and people often aren't honest even with themselves (or have an unrealistic self-view). The NSA psychological staff also points out that self-reporting is totally inadequate for identifying problems (as might be expected). Both of these honesty factors, deliberate and avoidant perspectives, are of course susceptible to polygraph examination due to that medium's focus on conscience. Having said these things, however, it must also be pointed out that research by Jayne (1988) cited by

Bosshardt et al (1988) seeks to demonstrate that the polygraph is less successful at obtaining confessions than integrity-type personal interviews or even computer questionnaire interviews: this being used by Bosshardt et al in support of their contention that an effective initial procedure is a suitable alternative. The point made by Dr. Rees (who strongly disagrees with Jayne and Bosshardt) and NSA is that an integrated process involving interviews, psychological reviews, background investigations, and polygraphs (not necessarily in that order), followed by monitoring and intervention, were all necessary for the most comprehensive behavioral reliability review. Since background investigation and adjudication requirements are the most standardized, modifications to them for purposes of use in EREs would be far more difficult to arrange than the other selection process components available. As these latter vary, they are seen as offering the best prospects for development for the more specialized and critical requirements postulated in this study. They might thus be designed to enhance behavioral reliability selection in a comprehensive program yet remain sensitive to the needs of multiple populations. This it is felt can be done, and specific processes for doing so will be presented further in this text.

C. FUTURE CONSIDERATIONS

Assurance that behavioral reliability requirements will meet mission objectives requires identification and validation of mission-oriented criteria. Existing selection standards such as DCID 1/14 have served well to provide suitable candidates in times of peace or tranquility. They may be less valid in an ERE: for instance, credit solvency is a reliable indicator of an individual's vulnerability in an environment where classified information must be protected and the individual is not at great risk, but it is both explicitly of less significance in an ERE where the individual's life may well be at risk and implicitly of unproven value as an indicator of an individual's reliability in such an environment. It is understood that in multi-mission, multi-population environments, accomplishment must be geared to specific population needs and resource availability. Further, any behavioral reliability modifications recommended should not affect existing means of reliability selection for other purposes or pose unrealistic burdens. At the same time, modifications to existing behavioral reliability processes are inevitable if personnel are to be suitable for and functional in EREs.

Section V. Performance Reliability in Extreme Risk Environment Contexts

A. INTRODUCTION

The man/machine interface is the definitive basic element of effective response to EREs, whether the interface is direct or indirect, operational or referential, regardless of the specific scenario presented. Whether his/her tool is a computer or a weapon, a bulldozer or a spacecraft, a telephone or a soldering iron, on virtually any scale, people use tools to alter a less than ideal environment. Today, however, even in high technology fields such as aerospace the human operators are acknowledged as being the limiting factors in the man/machine interface (Trejo et al, 1987; Driskell et al, 1990), yet this aspect often receives the least systematic, solution-oriented review. Even where it does (perhaps especially in high technology fields), the solution is likely to be perceived as the elimination of the human factor in the equation. In EREs, though, machinery itself will be stressed, quite possibly well beyond its design limitations. The result of complete reliance on machines where it might be avoided is at that point obvious: sooner or later, the machines will fail.

B. CURRENT POSITION

Machinery can be thoroughly tested in actual or simulated EREs. In many cases, people cannot, at least realistically enough to achieve the performance levels arising from confidence expectancy cited earlier by Keinan. Artificialities growing out of simulated EREs effectively preclude the ability to truly "train as you fight", to use the U.S. Air Force phrase, but few persons would willingly face a true extreme risk situation where death or serious injury was a significant possibility. Those that might, especially on a repetitive basis, may well not meet behavioral or psychological suitability screening requirements. Another important aspect to consider too is that the more senior members of groups or populations responding to or functioning in EREs are likely to be the most advanced in age as well, and the physiological factor becomes increasingly vital.

Planning for operations in EREs must include detailed examination of interpersonal and group dynamics. In an isolated operational environment (one in which there is no time or opportunity for relief of personnel), the success of onsite personnel in dealing with these issues will define

the success of the mission. As mission length increases, so does potential for sleep disturbance, anxiety, depression, irritability, and disruption of group cooperation and accomplishment (Gunderson, 1972). These problems are caused by both physical and social stressors relating to crowding, artificiality of sterile environments combined with likely separation from (and natural worries about) loved ones, lack of privacy, and forced interaction (Evans et al, 1987). As these issues are exacerbated over time, short term artificialized training in and of itself cannot deal with them. Again, selection appears to hold the key, particularly if combined with training.

Many mission requirements address operational issues from a perspective of system network and equipment efficiency; positions for operational personnel are then developed with an eye to perceived mission needs for the information or service generated by or from a type or category of source. In such environments, the enrichment caused by crosstraining in a variety of work is beneficial to stress resistance (Gunderson, 1972; Evans et al, 1987). Dr. Ginzburg in interview though noted that technical and mission operational staffs are likely to more fully adjust to decision making than decision makers to technical or mission operations. If candidate selection for particular operational requirements is politically driven or (even more likely) availability driven, analysis of candidate selection for those requirements is adversely impacted in direct proportion to the influence of the driver. Without such analysis, however, there will be insufficient assurance that candidates, minus additional screening aimed at identifying those among them who are able to cope with the required stressors and environment, would be capable of performing as necessary to accomplish the mission. Thus, the selection process may be placed between two difficult issues: can sufficient candidates be found if a more comprehensive screening is done versus will they be able to perform if more comprehensive screening is not done? The first part of the question offers both more promise and more hopeful responses than the latter.

C. FUTURE CONSIDERATIONS

It is essential to assuring that performance-based operational reliability requirements will meet mission objectives that unavoidable training limitations, interpersonal/environmental factors, and lack of type-oriented selection criteria do not mitigate against selection and retention of capable personnel for actual mission status. Obviously, use of new selection mechanisms of any type will cause a higher rate of personnel fallout if additional screening of any type is implemented, but without it the only assurance that personnel will perform as required in an ERE is their not having self-selected out...and this may well change when the chips are down.

It is possible though to enhance motivation, responsibility, and stress tolerance both in currently available and future candidates through a variety of means, and possible to develop programs that do so. Some have already been touched upon, and more will be addressed in Sections X and XI of this study.

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Section VI. Physiological Reliability in Extreme Risk Environment Contexts

A. INTRODUCTION

Extensive study of physiological reactions to stress imposed by a very wide variety of circumstances and environments including those involving personal risk or isolation and confinement has been made for generations. Cannon published his findings on what he called the emergency reaction and has more commonly become known as the fight or flight reaction in 1914 (Cannon, 1914). Substantial advances in physiological research into the effects of stress caused by the impact of harmful physical stimuli was done by Selye in the 1930's (Selye, 1936). In more recent years, much research has been done regarding the catecholamine and other chemical and chemically-related influences. The empirical nature of the subject has allowed for a more thorough understanding of both individual responses and the interactions between responses to be arrived at than in less readily accessible fields. As Herd (1991) has noted:

> "Because psychological stressors are difficult to apply in a controlled and quantitative manner, the physiological responses observed become an index of the stressor." (p. 314)

B. CURRENT POSITION

Despite the large body of validated research into catecholamine (e.g. norepinephrine, epinephrine, and dopamine) and corticosteroid (e.g. cortisol) related responses to cite only a very few of the pertinent ones, a translation of the results into extant PRP and PRP-like programs has not been effectively accomplished. We can ascertain to a meaningful degree the impact of various types of stress (e.g. heat and work load--Zakay et al, 1986; Carter and Cammeyer, 1989) on various critical functioning capabilities and perceptions--the cardiovascular system, for example (Herd, 1991; Henderson et al, 1990), and even less direct relationships such as motivation and aversion (e.g. Lovallo et al, 1990), relaxation (e.g. Benson et al, 1977) or emotions (Simonov and Frolov, 1984). Yet the common physiological review technique extant in PRP's and PRP-like programs is a medical records review, or at most a medical records review and comprehensive conventional physical examination aimed at verification of <u>current</u> ability to participate in a program at <u>current</u> stress levels. Although

medical reviewers do take into account anticipated stress and research results in certain highly specific isolated, confined environments such as Antarctic over-winters or submarine service, less attention appears to be paid to the rigors of some even more stressful environments, for example, nuclear combat. The reasons for this are because standards (DOD 5210.42 in the nuclear arena) are sufficiently vague to allow less screening to be accomplished, and the reasons for the vagueness in published screening is generally a reflection of the practical considerations of volumes of personnel requiring general review, unpredictability of specific nuclear engagement or other non-contained scenarios, general availability of massive redundancy in replacements for broad scenarios, and a need for lowest-common-denominator screening capability for scenarios requiring massive populations.

Nor are these the only problems. Some populations that might be expected to respond to ERE scenarios are allowed to participate at risk, i.e., with the individual participant having made a cognitive decision to participate with at least partial knowledge of the fact that to do so places that individual at greater life risk than others due to specific health problems. In some cases, comprehensive conventional physical examinations might be offered, but on a voluntary basis, for responding populations. In the latter case, experience has shown that substantial numbers of participants fail to avail themselves of the opportunity either because they feel no pressure to do so on an expeditious basis, because they don't really wish to find out (or have others find out) their actual current health status, and/or because they have unilaterally chosen to deploy at risk regardless. The consequences of all the above cited situations are potentially serious shortfalls during exposure to EREs.

C. FUTURE CONSIDERATIONS

Obviously, a continuation of the current state of affairs in the physiological review arena does not provide a great deal of assurance that populations deploying to meet ERE scenarios will in fact be adequate to the task unless redundancy of manpower is so massive and crosstraining so extensive and effective as to amply mitigate the effects of stress casualties; in an environment of drawdown of Federal resources to meet all currently anticipated contingencies, it is increasingly questionable whether these conditions can be met. Now more than ever, quality must be stressed over quantity. This is even more particularly true when considering smaller populations or those that must be relied upon in the greatest extremities. The field of physiology is broad enough and well enough understood to be able to play a far more significant role in the selection and retention of personnel whose physical constitution can be

best anticipated to respond appropriately when confronted with life-threatening stress. Physiology (and its subfields, particularly neurophysiology, psychophysiology, biophysiology, and endocrinology) is also capable of prescribing effective means to retain that appropriate status, and means of enhancing individual abilities to suppress the emergency reaction and permit continued suitable response to EREs, though it must also be admitted that much remains that can and should be done. Without a thorough review of existing capabilities and resources to meet specific ERE scenarios and/or the development of additional means to do so, however, the operational application remains the only test of efficacy. In an ERE, there may very well be no capability for recovery from (or even awareness of) physiological deficiencies that spawned failure of the necessary response.

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Section VII. Psychological Reliability in Extreme Risk Environment Contexts

A. INTRODUCTION

If compatibility and adjustment are primary determinants for stable group structure in a highly stressed environment, there is an implicit requirement for a select in process to obtain the most desirable candidates for EREs. Such a requirement does not always fit political and operational realities, and is inadequate by itself to meet security needs. These facts place additional demands upon processes used for stress tolerance enhancement.

B. CURRENT POSITION

No Federal agency was identified during this study that currently has in place a psychological reliability process designed to factor in issues central to EREs, which in sum relate to stress hardening to cope with such environments. Institutionalized programs in existence are geared to current, nonemergency or peacetime needs.

The authorities interviewed for this study who commented upon ability to provide psychological stress hardening were unanimous that it could be done. With the next breath, they generally agreed that they were unaware of any existing research and mechanisms to provide a systematic process for it at the desired level, or a selection capability for it. All were aware of psychological stress enhancement techniques for less severe environments, techniques such as envisioning and mentally rehearsing an act, fed by actual opposition tactics, and envisioning successfully completing the act; this technique has proven successful with athletes providing the activity and success envisioned are reasonable substitutes for field performance (Dr. Rees). Coping-oriented techniques might include relaxation through a meditative (Benson et al, 1977) or self-awareness/self-regulation (Stephens, 1987) approach.

Another approach as explicated by Driskell et al (1990) is stress training utilizing indoctrination, skills training, and confidence drill. Indoctrination informs individuals about the stress environment. This is commonly done in hazardous professions, but descriptions and even videos cannot adequately prepare personnel for the reality (or surreality) of actual EREs where they themselves are likely to be at life risk.

Skills training exposes personnel to the stress environment and causes them to experience stress based skill degradation adaptation to the stress environment so

performance returns to higher levels. Training or exercise artificialities will weaken the effectiveness of measured response, however, particularly if the participants are volunteers operating in a thoroughly disagreeable (and therefore more meaningfully simulated) environment. Even with nonvolunteers, such artificialities will distort perception of reliability if not of ultimate results.

The purpose of confidence drills are to give personnel the opportunity to operate in a stressed environment using solutions found and adaptation to increase their confidence in their abilities to perform regardless. Even if tests or exercises are successfully conducted from an operational and equipment standpoint, though, if the simulations do not accurately confront personnel with the emotional and functional stressors they will encounter in reality, there will remain serious doubts about the ability of personnel to deploy and function under actual operating conditions. The subject of stress training is explored in additional detail in Section XI of this study.

C. FUTURE CONSIDERATIONS

In the absence of ability to effectively use training to increase stress hardiness in personnel to the level necessary, such training as can be done in combination with other mechanisms offers the promise of substantially better results than might otherwise be expected. These mechanisms may include procedural, organizational, operational, and philosophical alterations of existing arrangements, and introspectively-focused self awareness techniques. In EREs, chemical means for response enhancement do not appear to be an adequately acceptable alternative due to the likelihood of lack of medical personnel to diagnose and administer them, and dosage, duration, and specific medication availability concerns, though some of the newer psychoactive drugs have been shown to be very effective in enabling enhanced performance from individuals who might otherwise be incapable of performing at all.

Section VIII. Monitoring Issues in Extreme Risk Environment Contexts

A. INTRODUCTION

Even though existing PRP's focus on a front-end selection process, all systems known to the lead researcher require a monitoring process of some kind afterward to assist in giving assurance that selected personnel continue to meet requirements for retention in the programs. As has been shown, the nonemergency focus of such programs and the often inadequate nature of established monitoring processes do not meet requirements for use in extreme risk environments. Some cultural or current popular impressions also suggest that monitoring implies a lack of faith in personnel integrity, unwarranted invasion of privacy, or "Big Brother" concerns, instead of a simple realization that people and personal circumstances change over time, and personnel directly involved are not always in a position to respond objectively to the changes. In many EREs, there are also genuine requirements to assure protection of classified information to the fullest extent possible.

B. CURRENT POSITION

Screening systems lacking a reliability program rely primarily on reinvestigation (if any), self-reporting of potentially adverse information, and voluntary observation and reporting by other personnel (who have very seldom been trained to monitor others). In the lead researcher's extensive experience in the area of Personnel Security (having among other things adjudicated over sixty thousand investigations for special access), there are serious deficiencies in the process, particularly in reliance upon self-reporting or voluntary reporting by others. Despite warnings as to the extreme sensitivity of highly classified information, clearly identified issues on which indoctrinated personnel are required to report, and stern warnings about the potential consequences of failure to report, admissions obtained are often literally years late if obtained at all, and observations by others are often perceived by one and all as accusations by untrained observers which have potentially serious consequences for accused and accuser. Many clearly identified areas are rationalized away by nonreporters through logical gymnastics that the persons themselves know are indefensible. The single biggest reason for not reporting is obviously fear over the repercussions of the act of reporting. Of the professionals interviewed in conjunction with this study,

NSA and CIA representatives felt self-reporting did not work (except to self-select out of undesirable duty, per NSA's representatives), Drs. Gerwell and Fiedler felt it worked on a situation-dependent basis, and Drs. Patterson and Sipes felt self-reporting generally did work, although admissions might come only after personnel had accomplished their own objectives.

C. FUTURE CONSIDERATIONS

As Dr. Glogower expressed (1991), any evaluation no matter how good is static. Situations are fluid and therefore need close review. Additionally, it may be seen from the material above that self-reporting and voluntary reporting by others is inadequate to assure timely, reliable reporting of events potentially affecting personnel. It thus appears that for programs in any environment where continuing reliability is important that effective monitoring is necessary.

Current monitoring programs for military personnel, as part of peacetime-use PRP's, are also geared to a nonemergency, peacetime environment. Monitoring personnel would be expected to report unreliability in a wartime environment to be sure, but this is largely implicit, and there appears to be little appreciation in existing PRP's for the change of monitoring focus in the transition from a peacetime to a wartime environment.

In a nonemergency monitoring environment, primary focus is on personnel suitability and physical issues. In operational EREs, the primary suitability focus would be on psychological readiness, and in the physical area on ability to perform a certain task vice good physical health. As reported in Radiological Factors Affecting Decision Making in a Nuclear Attack (1979) and Mickley (1989), it may be necessary to see some personnel sacrificed to accomplish critical mission tasks--much narrower, but much more important requirements. Personnel conducting monitoring activities must be able to shift focus and be aware of the increased need for vigilance in the different evaluation areas at a time when operational concerns are increasingly pressing. It is vital that they must be trained for both environments and the review shift process. Additionally, those who will monitor others must be thoroughly trained to do so, and neither the accused nor accuser faulted in the event of an understandable though inaccurate perception on the part of the monitor--this represents instead a training deficiency.

Section IX. Summary of Interview Results

A. INTRODUCTION

The interviews of authorities in the field of human reliability selection and monitoring conducted for this study constitute the broadest effort known to have been made in this area. Many authorities in a variety of closely related human reliability assessment fields were consulted in order to more quickly and effectively obtain a broader context cumulatively to evaluate more specialized experience and/or knowledge of individual interviewees against. The interviewees were advised that this study was a Director, OEO initiative to conduct basic research to determine the feasibility of development for possible implementation of a PRP for use in extreme risk environments, with actual scenario(s) unspecified. This, in combination with the open use of OEO/White House Military Office affiliation to encourage responsiveness, both intrigued and excited many of the interviewees, who were pleased that such an important but little-studied area would receive such high level interest. Many provided copies of related information they had authored and other research as cited earlier in this work, along with recommendations on additional sources and much good advice.

B. AREAS OF AGREEMENT

On a number of areas the interviewees were in general agreement. These included the following weaknesses in current research/application:

1. Information in general about human reliability in emergency events is lacking (due to low rate of occurrence).

2. There is a lack of specific information regarding reliability when events involve life risk to an individual, or to an individual and those emotionally close to him/her.

3. There are difficulties in accurately quantifying reliability break points.

4. Difficulties exist in quantifying the universally recognized difference in reliability where family or close associates are at life risk versus only the individual.

5. There is a lack of specific research into the suitability and performance areas sought vice suitability selection alone.

6. For many EREs, there are no measurement tools and very little factually-based information that address specific issues of suitability and performance dependability needed for personnel to operate in a particular environment.

The interviewees were in general agreement that the following could be accomplished:

1. Instruments could be developed to assess suitability and dependability of an individual in order for him/her to respond to life risk situations.

2. Instruments could be developed to assess functionality of individuals in life risk situations.

3. Personnel facing life risk situations could be inured to them by a variety of physical, physiological, and psychological means.

4. Reliable personnel selection could be made if they were chosen against the operational requirements of a specific scenario.

5. Physical fitness significantly enhances mental and emotional toughness.

The authorities interviewed were less sure or consistent upon a number of other issues, and tended to lean toward their own familiar areas on these:

1. Type of approach to the problem (behavioral, performance, industrial/organizational, or integrational).

2. Ability to assess variables in the interrelationship between life risk selection and responsiveness when family and/or close associates are at life risk versus when only the individual is.

3. Requirements for monitoring, or how to accomplish them. All in all, there were more strong opinions about value, frequency, purpose, and scope of monitoring than any other area, though no one actually opposed doing it.

4. Viability of reliance on self-reporting accuracy.

5. Type of validation process to be used for testing an HRP or its components.

6. Which currently available instruments would be suitable for integration into an HRP.

7. What model a program should follow.

In some areas only a few interviewees had comments, but these were relatively consistent:

1. Reardon, Ginzburg, Gerwell, and Fiedler agreed that cohesion was a significant factorable.

2. Rees, Kurke, and Fiedler emphasized the importance of not relying on a single medical/professional authority to build a program with due to potential essentially for a blindered, tangential outlook.

3. Reardon, Ginzburg, and Hibler (who was interviewed by Donald Brenno) emphasized the critical value-added benefit of cross-training.

4. Dowd, Strome, and Eddy all felt that voice stress analysis had reached the point of viability for inclusion in operational reliability screening.

Observations and analysis regarding the above will be commented upon in succeeding sections of this study.

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Section X. Models for Multiple Population, Agency, Level, and/or Scenario Extreme Risk Environment Human Reliability Program Structures

A. INTRODUCTION

One of the larger challenges presented for this study was to find or devise a human reliability program suitable for a variety of different populations with widely divergent missions, agency cultures, regulations, and approaches in a single structure that both accommodated their needs and effectively addressed their vulnerabilities in order to select and retain candidates of the best possible quality from both security and functionality aspects. Additionally and most significantly, the screening process would have to produce these results against and during multiple extreme risk scenarios. By use of a variety of methods, means will be proposed in this section to deal with the operational limitations that might be faced, mechanisms to develop programs, instrumentation, and validation that can be tailored to fit both mission requirements and human reliability concerns, and approaches to implement them. It should thus be possible both to develop a workable umbrella program and better fit the needs of the various populations within it as well as conform to political realities. At the same time, there may well be similarities that may be exploited: for example, there may be both operational and support populations, and these populations may fulfill similar functions and face similar challenges to performance and suitability from a particular extreme risk environment, regardless of agency affiliation. These, then, are the foci of proposed HRP development and implementation.

B. SELECTION STRATEGIES

There are basically two strategies used in any personnel selection process. As stated by Benner (1986),

> "The 'select in' strategy assumes that the desired and appropriate characteristics are known and further, a way to identify them exists. The 'screen out' process is less ambitious and infers the ability to identify undesirable characteristics and the elimination of candidates who exhibit them." (p. 15)

After dismissing the "select in" strategy as premature due to lack of consensus and specificity, Benner goes on to note in the same source that both stability and suitability are issues within the "screen out" strategy, which he feels to be more possible and practical.

Benner isn't the only one who feels a screen out process is more feasible: all personnel security processes currently in use by the U.S. Government rely to some degree, often near completely, on a "screen out" process. Operationally oriented selection processes on the other hand use just the opposite to select in appropriate candidates based on their background, expertise, and perceived "fit" within the organization. As Dr. Wiskoff observed in interview, selecting in is more of a capability assessment, screening out more of a behavioral assessment. In Government and contractor organizations where security clearances are required, a select in/screen out (Personnel/Personnel Security) process is used.

The opposite process also has clear validity in certain situations. For example, Captain Chandler, USN, who sat in on part of the interview of Dr. Glogower noted that New Zealand uses a combination of screen out to get rid of obvious or substantial problem personnel, then select in during a practical field test for the remainder in some of their (admittedly small) sensitive communities. In fact, this method is particularly well suited to team building and is not infrequently used for the purpose by many organizations.

The challenge in constructing a valid selection process for suitability and reliability is to avoid the tendency of psychologists to build what they personally think is valid, but rely too heavily on their own expert judgement to create, with the risk of establishing an arbitrariness that candidates can reclama (Benner, 1986). Dr. Fiedler, Dr. Kurke, and Dr. Rees among the interviewees all concurred as well on this aspect. Dr. Fiedler in particular expressed concern over the potential for tangential development if reliance was placed on a single dominant psychological authority, and Dr. Rees in response suggested a group of recognized experts for the purpose. Inwald (1986) recommends a number of specific guidelines to establish a reliability selection process within various checks and cross validations to avoid the problem as well. Options and recommendations regarding aspects of selection will be discussed further in reference to testing procedures later in this text.

C. TASK ANALYSIS

1. Orientation

At its most basic, there are only two types of population in any extreme risk environment that must be tested in order for a mission to be accomplished: operational populations (including direct mission support during operations) and populations indirectly supporting operational populations. This holds true regardless of other factors influencing either selection, retention, or

events such as mission, operational expectations of specific populations, and degree of sensitivity. For operational personnel, there are requirements for reliability in suitability and performance areas pre-, trans-, and post-emergency; for indirect support personnel, for suitability and performance reliability primarily pre-emergency. The operational populations must necessarily deal with much more serious and possibly extended stress than supporting, non-operational personnel, but the latter also have a vital role to play: without their pre-emergency reliability, operational elements may be unable to perform their own missions.

From this basic stance, other aspects may be factored that demonstrate operational similarities, then those that make specific populations operationally unique, and tools or types of tools identified to create an effective and ongoing assessment process for each individual in each population.

D. SUPPORT PERSONNEL

Personnel performing support duties to operational personnel fall into two basic categories: direct and indirect. Depending on particular scenario, direct support personnel may or may not be at life risk equal to or significant in comparison to operational personnel, and must be evaluated accordingly in an HRP. Indirect support personnel in EREs are less likely in many scenarios to be faced with as broad or continuing a life risk. The support communities may thus need evaluation and monitoring focused more to a pre-, trans-, or post-emergency scenario instead of the full scale, multi-level evaluation and/or monitoring process operational personnel are more likely to require. Use of even a minimal front-end screening can achieve a number of benefits in a more narrowly focused HRP for EREs, however:

1. It could fulfill the traditional PRP role of providing additional, otherwise less adequately covered, personnel selection support.

2. It could provide an initial screen for use in an operational or more directly supporting population.

3. It could provide an early warning mechanism for the individual and the organization that help was or would be needed (with a clear focus on treatment vice separation).

4. It could be used as a tool for identification of areas to focus stress tolerance training upon.

5. It could be used to support a request for waiver of some investigative requirements in an emergency.

6. <u>All</u> of the above.

R E C O M M E N D A T I O N

Establish a limited HRP screen even for indirect support personnel for EREs (which could also be used as an initial screen/identifier for operational selection and/or monitoring test instrument).

E. TESTING

1. Requirements

Should implementation of an ERE HRP be undertaken, the specific components of the HRP and the models for it must be developed and tested to demonstrate psychometric characteristics of validation, reliability/repeatability, and sensitivity. There are a variety of ways in which a program can be undertaken, and a number of them (with options) will be discussed in the following pages. In cases where multiple satisfactory options are feasible, the course best calculated to deliver the most effective product most quickly will be recommended.

2. Validation Processes

There are two basic validation formats that will be briefly examined in conjunction with this study: criterion and content and construct. The method chosen will dictate the approach taken to development and testing. Each has advantages and disadvantages.

a. Criterion Validation

This process essentially involves the creation of a measurement tool by (a) researcher(s) from individual expert judgement. The tool is then applied to an unscreened population of sufficient size to be able to mathematically document some measure of statistically significant sensitivity (often low in single digits). The tool must then be retested a sufficient number of times to verify repeatability of the results. Then, if necessary, the measurement parameters are reevaluated and different or additional variables or more specific language applied in order to increase sensitivity of the tool by narrowing the window of sought-after response.

The advantages in using such a format are that HRP's validated through such a process would meet scientific requirements for accuracy and repeatability and would provide the capability for a solid legal defense of decisions based on use of the validated parameters. The downside of using this method is that the smaller number of cleared psychological researchers increases potential to fail to identify alternatives to specific parameters and courses of pursuit, and the trial-and-error process requires a substantial time (one to five years) to produce refined

results. Additionally, there would have to be access to a substantial body of unscreened personnel for use as a test population, which is likely to be difficult or impossible in the case of ERE testing, and which would require substantial coordination if such a population was to be made available. Finally, facilities would be needed at least in the vicinity of the test population, with appropriately cleared and certified spaces or containers if classified research was undertaken.

b. Content and Construct Validation

This process was suggested by Dr. Rees as a means to link scores obtained in testing to specific evaluative factors. This method would involve identification and selection of a panel of nationally-recognized experts including from outside the intelligence, defense, or security communities. Criteria regarding what the populations the program would be applied to needed to accomplish and what they needed to be free from would have to be identified to the panel. These would then become baselines for the panel to build parameters to select upon. The panel would rely upon a consensus of their expert opinions to develop windows for selection against the baseline criteria, then establish windows for initial testing. These windows could then be tested against the actual populations.

Despite a shortened fine-tuning process compared to criterion testing and validation, there would still be a need to adjust and narrow criteria. Therefore, the use of standard Boolean configurations for fuzzy set application to develop mathematical models for computerized simulations of aspects agreed upon by such a panel is suggested, which should allow substantial refinement of parameters in alpha testing (without field or beta testing). Once narrowed by this process, the resulting product could be validated by field/beta testing against the actual populations.

There are a number of advantages that could be realized by utilizing the content and construct methodology cited above in conjunction with the mathematical process described. It would produce valid selection criteria that would be acceptable to the scientific community and thus be legally defensible, and would do so in far less time than criterion validation--months to years less. It would allow better concurrent testing of all aspects of human reliability, not just behavioral reliability for example. Panel size (five to seven voting members) would assure that likelihood of examining insufficient options or errors due to inadequate knowledge were minimized. One member of the panel would be responsible for moving the professional parameter identification and establishment process along, presenting majority and divergent opinions to the project manager, and getting closure on issues: he/she would not however be an arbitrator. Use of simulations testing would allow work to proceed even when operational factors were unavailable.

This method could also be accomplished in a manner that nurtures further and broader study, in that the panel members could be chosen from multiple facilities if a suitable representation of facilities were solicited and were to nominate candidates for the positions sought and have one or more of them selected for the panel. Much or all individual or even panel evaluation tool and mechanism development could be made available to the medical and scientific communities while in progress, and panel members should be encouraged to publish. It is anticipated that this would produce an effective cross-pollination effect, as panel and panel member work inspired others not directly associated with the effort to produce research of their own in the area, which may well collaterally resolve issues the panel might have otherwise had to undertake itself, while also suggesting alternatives that might prove useful. Thus the benefits of a single research project could be disseminated rapidly in a manner that both advanced the state of the art and engendered further interest and research that could benefit all, and do so more broadly, thoroughly, and quickly than a criterion-based effort. Additionally, the effort could be accomplished with panel members working in that role part time, such as two days a month, which would impact their home facilities only minimally, reduce research costs, and spur interest outside the panel in its research efforts. Although it may be argued that the operational method proposed above for a professional panel could be better suited to measurement tools of the pen-and-paper variety, both simulations testing and actual field testing are also proposed for the testing of instrumentation of a fieldable system. It is acknowledged that there are disadvantages to the content and construct methodology as a whole and for the proposed version in particular. These include on a broader scale the need for identifying and obtaining the services of a slightly larger professional group than criterion validation might (5-9 persons as opposed to 1-3), and getting a larger group appropriate security clearances as necessary. It would require use of some of the finest talent in their fields to assure that panel decisions were not readily assailable scientifically or legally, though the mathematical methodology proposed would mitigate at least some of this. It would also likely require higher travel expenses to bring remotely-located experts to a common location on a regular basis for panel meetings, and personnel turnover could also be a factor due to panel size. With regard to the specific content and construct panel format proposed above, it would also mean that during beta testing and possibly some simulations testing, it <u>might</u> be necessary to have the services of the panel members for more than the suggested two days a month (plus travel), but a number of factors involving training cycles and specific testing will mitigate this. In that the specific content and construct methodology proposed above offers both

substantial offsets to the disadvantages and can be accomplished for far less expense (essentially travel and expenses associated with panel meetings, beta testing, and purchases of samples of existing instrumentation for evaluation vice maintaining facilities and staff or hiring someone else who does), the format appears to offer distinct advantages worth pursuing.

3. Testing Process

a. Oversight

Regardless of validation approach selected, experts selected to develop and operate the testing and validation process are likely to have their particular areas of specialization as their primary perspective on HRP development. Coordination and management of test/evaluation/implementation/operation of an HRP requires a far broader perspective, but with a primary security orientation. A Program Manager from Security could also thus serve as the focus for logistical and coordination issues pertaining to the development, testing, and implementation effort, while retaining an overall focus of effective performance within suitability parameters before, during, and after operations in EREs.

R E C O M M E N D A T I O N

Implement development, testing, and fielding of an HRP under Security aegis.

b. Professional staff

As noted earlier, development and testing personnel requirements reflect the type of validation strategy chosen. Projected minimum requirements for an HRP of the sort envisioned in this study would include the following personnel.

CRITERION--Two clinical psychologists with extensive experience screening in an I/O environment, or one clinical psychologist and one I/O psychologist throughout. A psychometrician would probably be necessary periodically to assist in assessment of results. A secretary/technician capable of assisting with testing administration and performing secretarial/clerical duties would be needed throughout. During at least part of the development and testing process, some or all will need to be co-located with the test population. Operational personnel would have to be more sensitive to any security nuances, however, as this method does present more inherent security risk than the content and construct method. Materials produced though would in many cases not need to be classified.

CONTENT AND CONSTRUCT--A panel of at least five and preferably seven leading professionals would be needed to develop and guide the testing and validation effort. Though a primary purpose of the group size is to assure greater likelihood of more effective results by requiring consensus, it also presents the opportunity to increase breadth of expertise available: it is suggested that a five member panel be composed of an I/O psychologist, two clinical psychologists with experience in I/O environments, a psychiatrist, and a physiologist as voting members, one of the panel additionally serving as Professional Director. A seven member panel would utilize the same specialists plus a neuropsychologist or neuropsychiatrist with I/O environment experience, and a medical administrator to serve as Professional Director in leading the panel. Non-voting members should include a psychometrician and a Personnel Security Specialist.

BOTH STRATEGIES--As deemed necessary or appropriate, occasional specialized governmental support as follows would be needed: a doctor with medical policy expertise to assist with policy integration issues (an excellent choice for Professional Director if experienced in medical administration), a personnelist, a lawyer familiar with governmental scientific research liability case law, a training officer, a mathematician with psychometric or statistical experience, and a programmer for the operating system employed. All would require sufficient familiarity with ERE scenarios screened against to provide effective input, which may result in additional requirements for security screening for such panel members.

c. Population Requirements and Operational Coordination

As earlier stated, there would be substantial differences in test populations depending upon validation process chosen.

CRITERION--This process requires a large population (several hundred to preferably thousands) of entirely unscreened personnel. This unfortunately eliminates the eight thousand member U.S. Air Force Security Police community, whose field level training elements had expressed interest in being tested for such an effort. Preliminary inquiries have indicated that it might be possible to utilize unscreened Air Force trainees, presumably different phases of testing being done on different groups to minimize impact on training schedules. An effort based on this test population would of course require establishment of a presence on or near Lackland Air Force Base in San Antonio, Texas.

It may however be more appropriate (and accurate) to use test populations more analogous to the actual populations to be screened for EREs, should it be possible

to identify them: patterns of thought, relationships, and responsibilities may vary substantially between basic trainees and many ERE populations, particularly operational ones, and might throw off higher levels of sensitivity measurement to some degree.

CONTENT AND CONSTRUCT--Testing could be conducted on actual populations on a continuing basis, with testing in the field under simulated conditions. Although most testing could be done in more quiescent periods, such testing under field conditions has obvious advantages, but it is suggested that non-obtrusive methods, if used, would be a more desirable approach under such circumstances. This approach has the advantage of time saving due to availability of populations if development and implementation are desired, accuracy for the specific purpose (to the degree possible in an artificial environment), substantially greater security assurance, and lack of need for facilities on an extended basis. Time lost for additional panel selection requirements in a content and construct process should be offset by a less complex, shorter set-up time as opposed to a criterion-based strategy.

d. Instrumentation

A variety of instruments will need to be devised for ERE's, including highly specific tools for use in particular threat scenarios due to the current lack of availabile tools. Although some are anticipated to be pen-and-paper instruments, these are not seen as adequate of and by themselves, at least for deploying/operational personnel: the problem is that people intentionally (due to unwillingness to self-report for whatever reason) or unintentionally (through misunderstanding, or more often, inaccurate self-perception) can skew results of a single instrument. The uniqueness of extreme risk operational environments would be especially likely situations for unintentional error due to lack of experience with circumstances of the types postulated, or in some scenarios, even an analogue. Exercises, due to the inability to introduce sufficient realism into the training experience are not likely to be analogues (and if training were capable of producing the necessary realism for EREs, it would soon also produce a dearth of participants). Although instruments can be devised to address behavioral, performance, psychological, physiological, and monitoring areas, specific tools and mechanisms of and by themselves are similarly limited: life style polygraph, favored by Dr. Rees for its ability to force accuracy in self-perception, is a behavioral and physiological measuring tool only; it cannot address psychological or performance aspects. Physiological screening processes, while covering that aspect well and possibly some psychological and/or performance aspects (depending on configuration), can be cumbersome. But an effective, validated combination of instruments can provide the necessary coverage and accuracy.

The best approach to the issue of specific instrumentation for an HRP needed for missions in EREs would appear to be a multi-faceted one incorporating both existing investigative means (background investigations with screening and investigative interviews) and tools specially designed to thoroughly cover particular reliability aspects based on specific mission requirements and status (operational or nonoperational). The specific reliability instrumentation must be developed by experts. They should be provided with necessary baseline material to formulate the tools and testing process needed. In addition, more specific criteria regarding system structures, application, and assessment requirements within scenarios can be addressed to fit the mechanisms into an HRP.

F. MODELS--FRONT END SELECTION

1. Introduction

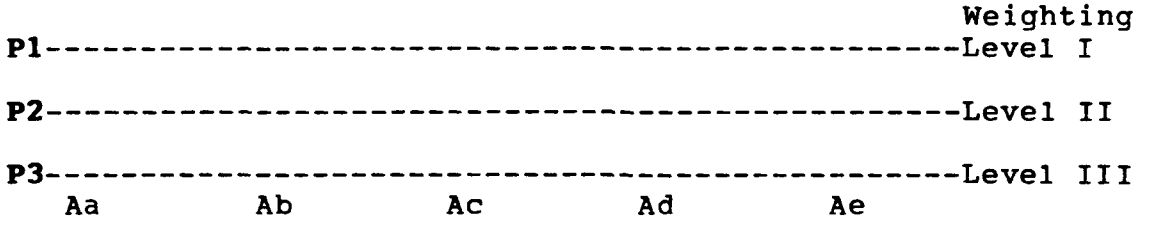
A number of specific and distinctive models of HRP system structures will be proposed on the following pages. With one exception for indirect support elements only, all are designed for use with operational, support, or both categories of personnel. They are designed as schematic structures only to accomplish the overall purpose of reliability assessment, but do not include yet-to-be designed specific instrumentation or existing measurement tools (e.g. MMPI II) that require professional justification or others (e.g. polygraph) that require a policy decision before incorporation into an ERE screening process. The models will provide adequate detail to allow productive decisions regarding desired system structure. Having selected a model structure and decided upon preferred validation strategy (either of the two proposed earlier can be applied efficiently to any of the models), a project manager and experts can be obtained to flesh to structures out.

It should be stressed that for all models suggested, the purpose of evaluation is for diagnostic vice determination purposes. Early detection in screening or monitoring must be followed by intervention. After a thorough review of the issue(s) surfaced, the diagnostician should make a report to the appropriate Personnel Security officials to pursue from there.

2. Sliding Scale

This model is designed to provide a full-range program for multiple populations, with each population being evaluated separately against each of the assessment criteria:

Figure 3



where P1 through P3 represent different populations to be evaluated, levels I-III represent minimum score levels for acceptability within a particular population, and Aa through Ae represent different assessment criteria. Thus population P1, though evaluated using the same tools as population P3, may be considered to require a higher degree of capability to perform certain activities at a higher stress level due to its specific mission requirements. Population P3 may be able to perform its mission perfectly well at the less sensitive Level III assessment category. Only the weighting of the criteria varies. Factors outside the variability scale, such as a requirement for a background investigation meeting DCID 1/14 investigative and adjudicative criteria would continue to be applied as currently directed with this as with all models proposed.

There are a number of advantages to the Sliding Scale model:

1. All personnel are assessed by all instruments, giving the broadest overview.

2. Tailoring for population variables is possible, due to variable weighting.

3. It is relatively easy to administer.

4. It allows an overall system to be in place fairly quickly.

5. Different assessment tools can be used in a centralized or decentralized locations.

Disadvantages of the Sliding Scale are as follows:

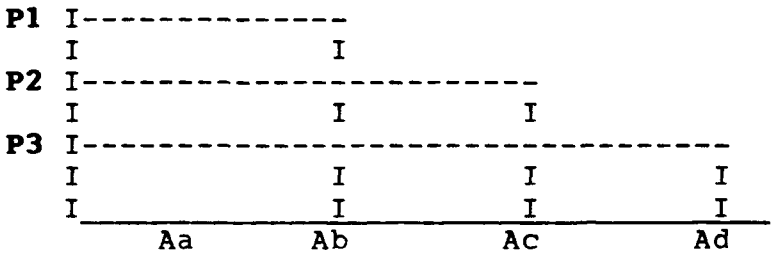
1. It needs to be fully developed before effective use.

2. Facilities and personnel may not be available to provide all testing required for an effective and efficient operation.

3. Layered Model

Whereas the Sliding Scale model is designed to test all populations to some degree on all assessment criteria, the layered model tests all populations equally on criteria used but not against all criteria. All would be tested against some criteria, and some against all, thus:

Figure 4



where P1 through P3 are evaluated populations and Aa-Ad are assessment criteria. In the model, populations P1 through P3 are all tested equally in criteria Aa and Ab, but P1 is not tested further.

Advantages to the Layered model include the following:

1. The same instruments and weighting are used throughout.

2. It's highly cost effective: testing beyond specific population needs is not done.

3. It places less demand on testing and assessment facilities and personnel compared to full-range systems.

4. It's easily administered.

5. It allows easy shift in personnel status due to accretional nature as opposed to modular or mixed systems.

Disadvantages include:

1. It has the least flexibility to political sensitivities.

2. There is structural inflexibility in format arrangements.

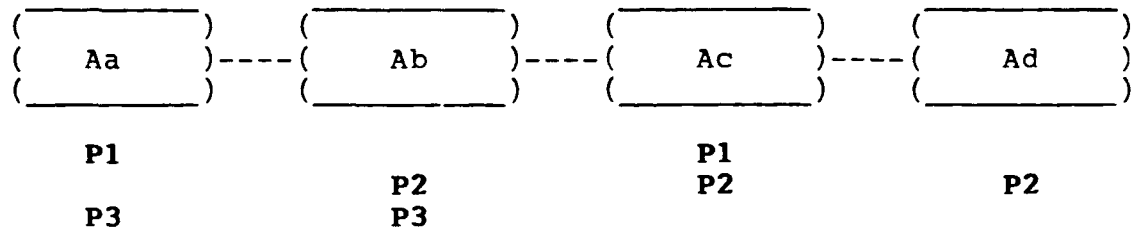
3. It is easiest to target from a security perspective (though still very difficult, especially at more extensive testing levels).

4. It needs to be fully developed before effective use.

4. Modular Model

This model varies from the others in that it tests all populations against at least some assessment criteria, with the same weighting applied to all criteria used. Diagrammed, an example of it would appear as follows:

Figure 5



Any number of configurations can be developed for testing a particular population,limited only by the number of assessment criteria times the number of populations to be tested, yet since each assessment criterion (instrument) remains the same (or works the same way), manageability is retained.

Advantages to be found in the Modular model include the following:

1. It provides a highly flexible structure which allows ready tailoring for specific population needs.

2. It has great sensitivity to policy issues.

3. It's very cost effective: only testing perceived as required is done.

4. Administration of testing instruments remains constant.

5. It can be implemented as testing instruments, facilities, and personnel become available.

There are also disadvantages to be found in this model:

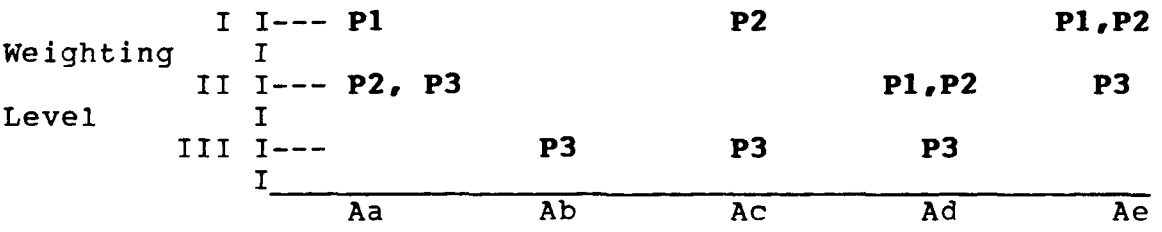
1. Program administration is more complex due to different arrangements for different populations.

2. It's more difficult to assess continuing evaluation support requirements.

5. Mixed Model

In the Mixed model, all personnel would be tested against all or some of the assessment criteria at the same or different weighting. A sample schematic might appear as follows:

Figure 6



As such, this model is designed to incorporate the greatest degree of personnel selection variability while at the same time providing maximum structural flexibility and capability for system adjustment.

Advantages of the Mixed model include:

1. It has maximum population assessment flexibility.

2. It demonstrates maximum structural and adjustment flexibility.

3. It presents a very tough target to defeat from a security perspective.

4. It allows the best individual fit for the broadest number of different populations and missions.

5. It could be implemented as testing instruments, personnel, and facilities become available.

There are a number of disadvantages, however:

1. It's highly complex to administer and operate.

2. It's not very cost-effective unless truly large numbers of candidates are to be processed.

3. It requires substantially more effort to develop and evaluate.

4. It's likely to promote confusion and frustration.

5. It requires more centralized testing.

6. Nondeployment Model

Earlier in this study, a testing instrumentation was proposed for use by both operational and support elements. Admittedly, the scope of effort required to administer such instrumentation could be substantial in large populations, depending on configuration. Alternatively, such tool(s) could be used either for nondeploying (indirect support) personnel, as a first screen for deploying (operational and direct operational support) ones, and/or for monitoring purposes.

Despite their individual screening limitations, pen-and-paper instruments offer the best option from a logistical standpoint to enhance personnel security by allowing improved intake screening and early detection of potential difficulties for effective intervention and treatment. In order to achieve all these objectives, such a model should contain instruments that meet the following criteria:

1. Testing instruments should be readily administerable by local security personnel with minimal training.

2. Testing instruments should be sensitive enough to meet general program needs while not presenting undue burdens to tested personnel (i.e., no MMPI I clone).

3. Testing instruments should not be so straightforward that desired answers are obvious, yet not so complex in language as to confuse the average intellect.

4. If multiple question formats are used in a pen-and-paper instrument, multiple formats should be used for monitoring purposes where regular observation is impractical, impossible, or where a Monitor's (a person) effectiveness is being checked.

5. Screening of test instruments should be centralized and automated if possible.

6. Testing instruments should be able to provide clarification of personal observations obtained during monitoring, and should be used for that purpose.

7. Format of the tool(s) should be suitable for use both in intake screening and monitoring.

As noted previously, pen-and-paper instruments are imperfect screening/monitoring tools, and will not achieve as high a success rate evaluating personnel as a more complex, integrated process will. They should be able to be formatted to mitigate to a statistically significant percentage either intentional or unintentional skewing,

however, and the obvious advantages of such easily administered, flexible, cost effective, and security enhancing tools far outweighs the weaknesses presented. Since a tool(s) should be used solely as a diagnostic not as a determination, there should be no fears either that incorrect responses mean that the person being tested is to be separated: should significant pathology or investigative criteria be suggested by the device(s), a thorough followup psychological or psychiatric screening or limited investigation of the criteria information should be conducted, as appropriate.

G. MONITORING MODELS

1. Introduction

A thorough but practical monitoring process is essential for the maintenance and operation of an effective HRP, but as noted previously, existing programs generally share a weakness in this area. This is however one area in which extant programs share a common general purpose with the one proposed in this text: continuing assurance that personnel in particularly sensitive populations can continue to be relied upon in life-threatening emergency situations. The DOD programs are designed to provide continuous monitoring, but have some serious weaknesses in training and application. Additionally, it may not be possible to provide continuous monitoring for all populations that must be relied upon to respond to particular emergency scenarios. Therefore, it may be necessary to look beyond the straightforward approach advocated by the DOD programs in order to achieve more practical results in such scenarios: for this reason, multiple monitoring configurations are examined in this section.

2. Continuous Monitoring

As it implies, this is a relatively continuous, ongoing, essentially nonobtrusive review process during work hours and possibly social occasions by supervisors and/or peers. Self-reporting of criterion information is a requirement. Intervention by the appropriate agent upon the surfacing of criterion information by any means leads also to suitability rereview if deemed to meet regulatory requirement. This model was supported by the largest number of interviewees, including the NSA staff, Dr. Rees, and Dr. Glogower.

A number of assumptions must be made for a continuous monitoring system to operate efficiently:

1. All monitors must be trained to detect criterion activity or information, and how to act upon it.

2. Populations to be monitored must be readily observable on a daily or near-daily basis, and for extended periods.

3. Intervention support must be readily available on a continuous basis.

4. Monitors themselves must be monitored.

5. Professional retesting on a periodic or aperiodic basis is necessary to maintain the validity of ongoing nonprofessional observation.

Although a continuous monitoring system as described is capable of detecting and intervening on criterion issues even where self-reporting fails to function adequately through either deliberate (concealment) or nondeliberate (ignorance) means, there are serious weaknesses in applying such a format in scenarios where key personnel or even majorities of particular populations who would be expected to deploy for or support operations in an ERE either travel too frequently, work at offsite locations too much of the time, work in relatively isolated areas, or work in areas where they might be the only individual required to respond to a particular scenario. Since these features are likely to embrace many personnel and populations required in ERE's, the continuous monitoring model may well lack sufficient practicality for application in ERE's.

3. Periodic Monitoring

Periodic monitoring need not be simply the same as continuous monitoring on a less frequent basis. It can readily differ in a number of operational assumptions:

1. All monitors still must be trained to detect criterion activity or information and how to act upon it, but may be fewer in number and/or more professional in concentration.

2. Populations monitored must be available at scheduled times.

3. Intervention support must be accessible as needed.

4. Monitors themselves must be periodically monitored.

5. Professional retesting on a regularly scheduled basis is still needed as a check on validity of monitored observations.

The periodic monitoring system is obviously easier to administer, but its many faults are almost as obvious:

1. Personnel with problems can and will dodge monitors, or be able to conceal their problems for the limited time monitors are available.

2. The "snapshot" nature of the process (to use Dr. Glogower's word) makes it very difficult for monitors to develop a thorough understanding of the individual, and thus effective decisions regarding him or her.

3. If monitors are a separate or semi-separate group, by whom and how are they monitored? Most likely, they would be monitored periodically by each other.

4. Aperiodic Monitoring

The aperiodic monitoring model has close parallels in the DOD random urinalysis or polygraph programs. As such, populations know only that they will be monitored and/or tested on a random basis. This method is supported by Dr. Kurke for activities for whom continuous monitoring would not be feasible. It does offer a variety of advantages to a dispersed operational environment:

1. It requires trained monitors, but as with the periodic model, these may be fewer in number and specialize to some degree.

2. It's very well suited to variable, highly mobile populations.

3. Intervention support is required only on an as-needed basis.

4. It allows discreet monitoring and variation in monitoring patterns.

5. It allows monitors to be readily monitored.

6. It can accommodate professional retesting on a continuing basis to verify validity of monitor observations.

There are of course some tradeoffs involved in using an aperiodic monitoring model:

1. As with periodic monitoring, it presents only a "snapshot".

2. Personnel with problems meeting intervention criteria may be missed, at least for a time.

3. Retesting is more disruptive to tight schedules or certain types of assignments, though the nonobtrusive observation process does not affect schedules.

5. Mixed Variable Monitoring

If a continuous monitoring model is impractical, and a periodic or aperiodic one is felt to leave too many holes, perhaps a combination of the three can resolve some of the failings of all. The combination proposed in this model would utilize supervisory and peer observation of all personnel on an "as available" basis wherever they might be, with random retesting.

The Mixed Variable Monitoring model is designed to incorporate as many advantages of the other models as possible. These include:

1. It accommodates maximum flexibility in availability of monitored personnel.

2. It minimizes deviancy crediting by a single monitor.

3. It eliminates need to separately monitor the monitors in a smaller, narrower system.

4. It backs up observations with a random retesting mechanism, whose overall frequency and format is adjustable.

5. Though not continuous, it provides a far more comprehensive view than "snapshot" models.

As with other monitoring models, there are tradeoffs:

1. It requires a far broader and more continuous training effort than models using fewer monitors.

2. Intervention support must be continuously available.

3. It is more costly and complex to administer than "snapshot" systems.

6. Monitors and Process

The types of personnel considered especially suitable for selection as monitors has been discussed earlier in this report. Regardless of who or what type of personnel are chosen as monitors, however, certain requirements remain consistant:

1. They must receive effective initial training with periodic followup training. Simply telling people to basically "look out for and report anything 'hinkey'" without their having a clear understanding of criteria to react to will be disastrous.

2. Monitors must be aware of and trained in the shift in criteria that will take place transitioning from a nonemergency to an emergency environment.

3. Monitor observations must be backed up on a regular basis by professional retesting.

4. For objectivity, monitoring and intervention must be completely separate.

5. For effective performance, monitoring must be a nonobtrusive process. Creation of a "big brother" or "Gestapo" atmosphere would be destructive of both performance and the evaluation process.

6. Monitors must have sufficient access to personnel to be able to reliably detect variances in behavior, performance, and health.

7. Monitors themselves must be monitored by others at some point, if not peers at the operational level, then at supervisory or organizational level.

Suggestions that emerge from the above criteria are that personnel selected as monitors should have sufficient time available to observe individual activity in enough detail as to be able to make informed decisions. They must be alert to the issue of deviancy credits, yet at the same time adequately trained (with reinforcement) not to overreact. And they must be constantly alert to the need to remain objective.

Another issue that suggests itself upon review of the above is that monitoring will also be needed in an operational environment: in fact, it will be vital. Monitors in the operational environment may very well not be the same ones as previous, nor will the reactive criteria be the same. Additionally, it is obvious from earlier remarks that the most effective monitoring arrangements will not be able to contend with the situation presented by the most mobile population members. For them at least alternative means of continuing evaluation will be necessary.

7. Retesting

Some form of retesting process is necessary in any monitoring program as a verification tool to provide continued assurance that the rest of the program remains on track, and to provide a regular professional review in support of any nonprofessional components of the process. Depending on the frequency of retesting determined necessary by the experts the process itself might range from a tool with characteristics similar to the one proposed earlier for nondeploying personnel, to that or another tool and an

interview with a psychologist, to a more comprehensive process probably incorporating review of physiological status (in fact, the NSA staff suggested that more physiological than psychological change might take place over a five year period for a population as a whole) and possibly proactive cognitive testing (also suggested by the NSA staff). Separate instrumentation specifically designed for the monitoring program might also be developed but is felt to be redundant and possibly productive of confusing results since monitoring retesting should be remeasuring previously assessed criteria.

8. Intervention

An intervention capability and mechanism is an essential part of a monitoring program, although of course it may also be used for entry evaluation as well. The purpose of having intervention capabilities is as previously stated, to provide professional review of potential issues detected, and to afford retesting and revaluation of monitored populations. As a diagnostic vice a determinative process, it should provide a professional opinion concerning continuation or separation to the existing personnel security process for a final decision. Since this must be professionally staffed, there are only two options for acquiring the capability: create one or gain access to an existing one. The NSA staff recommended the former course as best suited to providing a capability geared to specific organizational needs. In addition, there are other advantages to such a system:

1. It offers better assurance of quality control through concentration on a specific capability.

2. It accommodates centralized administration and greater responsiveness to change in operational or security requirements.

3. Allowance is made for clear control of ongoing testing and refinement of new instrumentation and methodology.

There are a number of obvious significant disadvantages to such an approach, too, including:

1. It requires creating a new organizational capability, with attendant staffing, logistic, and administrative requirements.

2. It's very expensive.

3. It creates a bureaucracy that will be less flexible to organizational/administrative fluctuations.

By comparison, acquiring the necessary capability from outside offers other possibilities, both good and bad, and can be sought either from a government or contracted organization. These are summarized below as:

GOVERNMENT ORGANIZATION--

Pluses: Uses existing structural and professional capability, so is faster online, and may well be the most cost effective option.

Negatives: Unless special arrangements are made, in-house needs will likely be met first.

Host agency fluctuation in evaluated populations will affect external support capability.

Host agency policies may affect ERE HRP efforts, "orphaning" the program or affecting perceived support requirements.

Such program capabilities as are in place currently are geared to administering fully developed instrumentation and not originating improvements or new tools.

CONTRACTORS--

Pluses: Probably the most flexible from security, operational, administrative, and organizational standpoints.

Very capable of modifying or creating instrumentation to meet changing needs, and can be available as necessary.

Negatives: Probably the most expensive option.

It places a very critical personnel security evaluative responsibility outside the government.

H. RECOMMENDATIONS

1. Strategies

The model structures set forth earlier in this section are capable of being used either for selecting in, screening out, or any combination of the two. The decision as to which or what order or combination should be chosen may be either political or expert opinion.

R E C O M M E N D A T I O N

Continue with the current select in (Personnel)/screen out (Personnel Security) process with informal select in for teams/staffs not requiring greater formalization of the latter process.

2. Application

The models proposed earlier in this section are designed to be applied to multiple populations and configurations. Specific population requirements may be a policy decision, but should be tempered by a consensus of expert concurrence in grouping for evaluation by coincidence of variables, which of necessity requires expert decision.

R E C O M M E N D A T I O N

An HRP should be established for appropriate populations, with application of evaluation and monitoring components to meet specific mission criteria as designated by expert professionals.

3. Evaluation

Establishment of an HRP for EREs will require development or adaptation of a variety of evaluative/diagnostic instruments due to the especially rigorous nature of such environments. At the same time, the organizational diversity of candidate populations mandates an extraordinary requirement for flexibility in program structure. Process selection in a multi-population environment must be a policy determination, but the flexibility afforded by the various model structures allows ready expert professional addressal of the specific instrumentation necessary to flesh them out. Either of the primary validation processes may be used to achieve goals meeting these requirements, so the following recommendation is geared toward selecting the process considered most likely to produce the most broadly integrated HRP in the least time for the lowest cost and security risk.

R E C O M M E N D A T I O N

Use a content and construct validation process as described earlier in this section. Develop/adopt instrumentation as deemed essential by expert opinion to meet mission requirements.

4. Models--Front End Selection

It would be possible with any of the model structures proposed and either validation process described to construct an effective HRP. Hence, the decision as to appropriate model may be made on other factors pertaining to the particular strengths of specific structures for the missions and populations to be supported and of course policy realities. As with the preceding recommendation then the following one is that which is calculated to give the most "bang for the buck". Of necessity, it is not geared to specific population and mission requirements, as these are not identified.

R E C O M M E N D A T I O N

The Modular model appears most effective for meeting the broadest range of screening concerns, capability,and cost effectiveness. It therefore appears to be the best option overall, though it must be noted that: 1) the Mixed model is very similar, and differs primarily in providing somewhat more flexibility offset by more complex administration, and 2) the Sliding Scale is the most comprehensive.

R E C O M M E N D A T I O N

The non-operational model is recommended for inclusion as a first module in <u>any</u> of the larger structures proposed instead of as a stand alone in order to permit ready transition in status and inhibit redundancy in screening.

5. Monitoring Models

Practical considerations must be the key determinant where monitoring models are concerned, because although those presented all have validity under certain conditions only one will best suit a particular scenario application.

R E C O M M E N D A T I O N

The Mixed Variable model appears to be the best choice for a single program incorporating disparate populations, scenarios, and missions because it offers the greatest flexibility and coverage in such conditions.

6. Intervention

An effective intervention mechanism and operation can be created using any of the options presented, and if monitoring (or in most circumstances, front end selection too) is to be used, some form of intervention is mandatory

in order to properly evaluate observations made. Except in the behavioral area, an investigation alone is not likely to surface events or precipitating factors. Even if it does, an investigation takes far more time and has no strong assurance of producing usable results in the reliability arena. In many cases, a combination of investigation and intervention testing and/or evaluation offer the best capacity to obtain information necessary to resolve issues and provide the most accurate personnel security adjudication.

R E C O M M E N D A T I O N

Obtain necessary evaluative and intervention capacity from existing government sources. Of these, a source with at least limited research interest and capability would be best suited for the needs of an ERE HRP.

7. Oversight

Although a general case was made earlier in this section for security oversight, if multiple populations from various organizations and entities are to be included in an ERE HRP structure, then a mechanism must be emplaced that can do so across agency lines. The primary orientation would remain one of security, but a broad policy implementation capacity would have to be added.

R E C O M M E N D A T I O N

Utilize an appropriate security oriented oversight group for a multiple agency HRP. If the effort were to remain within a single agency, oversight should be by the senior security official.

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Section XI. Other Issues and Recommendations

A. INTRODUCTION

Some of the real benefits of any basic research are the throwoffs generated, those relevant but not directly pertinent or required discoveries that are made as a collateral development of the primary themes and issues. This particular research has been no exception. A number of items have surfaced as alternatives or beneficial considerations that may well serve to make an ERE HRP more effective.

The items cited in the following subsections are of a disparate nature due to the collateral nature of their origin. No attempt was made to integrate them into the primary models or with each other. Most of them have previously been examined from other perspectives: this study examines them from the perspective of human reliability. They remain options for the most part, with the exception of the last one of all, Community Coordination for Fit, some form of which is essential if a multi-agency HRP is contemplated.

B. STRESS TRAINING

Even in populations that train as often as feasible in order to increase and maintain proficiency with operational procedures, systems, and mission requirements, there is seldom training provided to increase stress tolerance. Much of the stress tolerance training provided in military-oriented programs such as the Navy's SERE (Survival, Evasion, Rescue, and Escape) or SEAL (Sea, Air, and Land) programs is directed at narrow population groups with very specific missions. While obviously beneficial, these techniques are not suitable for all ERE populations, nor do all ERE scenarios resemble SERE or SEAL operational environments.

Stress training in an operationally oriented environment should deal with issues other than physiological stress tolerance or psychological passive or active coping techniques to deal with the results of stress. It should be a proactive process aimed at increasing resistance to sources of stress. As stated by Driskell et al (1990):

> "Researchers in the stress field have identified three critical components of stress training: a) indoctrination, b) skills training, and c) confidence drill. The purpose of the

> indoctrination component of stress training is to provide the individual with information about the stress environment. Knowledge provided in this manner is relatively straightforward, and may be delivered via classroom sessions, handbooks, and the like. The purpose of skills training is to provide the individual with exposure to the stress environment, have the individual experience skill degradation in terms of decreased performance accuracy or speed, and then develop work-around procedures to allow adaptation to the environment so that performance returns to an acceptable level. The purpose of the confidence drill is to provide the individual with exposure to the stress environment, to allow the individual to operate effectively in that stress environment, and to develop positive expectations regarding his or her ability to perform under stress conditions." (p.33)

Sound familiar? In this model, however, system performance is manipulated to create, confront, challenge, and be conquered by an effective response to an operational degradation rather than an equipment-oriented troubleshoot and reroute designed to teach only a specific fix for a specific problem: the latter may instead be a vehicle for improvement of the operator's ability to respond. The intention is to create a high confidence expectancy so that:

> "...in dangerous situations, individuals who have a high confidence expectancy would focus on the task at hand, while those low in such expectancy would direct their attention to the danger stimuli and attempt to avoid them." (Keinan, 1986, p.186)

An effective HRP can be constructed for EREs without utilizing stress training, but to use it productively would enable higher confidence in all aspects of reliability focused upon in this report. Selection for stability that might be enhanced by training provides the best hope for continued security and performance in an operational environment. Rote or hands-on hardware training will not accomplish the tasks effectively in an analytical or decision-oriented environment (though it does in a military close combat environment) because knowledge-related problems are not degraded by stress, whereas computationally-oriented spatial demands are (Wickens et al, 1989).

C. CROSSTRAINING

Many operational populations already do at least some crosstraining, in order to create greater depth in available resources, as stressed by Dr. Ginzburg in interview. It

also has value as a stress-reduction mechanism. In volunteer-based ERE populations, if any, and even many involuntary ones, crosstraining will help deal with a fact of life in operational conditions: failure of at least some personnel to report for duty as required.

Thorough crosstraining would prevent or minimize single point of failure issues, increase personal and group confidence in their endurance, and increase stress tolerance by adding variety to tasks and perceived usefulness. The tradeoff is longer and/or more frequent training.

D. MOTIVATION AND RESPONSIBILITY

It reflects the highest credit on their remarkable sense of "duty, honor, and country" as the Army puts it that personnel may be found to volunteer for or accept assignment to populations responding to ERE situations. It also speaks much for their motivation and level of responsibility. Yet for all this they remain human beings, and they will face again major decisions they thought they had already settled in their own minds if they must deploy for operations in or supporting an ERE scenario instead of just practicing during an exercise, or remain on station at a location likely to be destroyed momentarily because the greater situation demands. Without a reliability program that has as a partial object the maintenance and enhancement of motivation and commitment in the most extreme of stress conditions, many more will be likely to fail the challenge than would be the case otherwise. This will create greater security risk in a number of areas including response actions and the securing of replacements, and will obviously degrade operational capability.

Motivation and responsibility are primarily behavioral characteristics. Behavioral aspects of an HRP to support selection and operational effectiveness should focus upon means of selection and screening of candidates that not only meet ERE requirements, but demonstrate clear likelihood to continue to meet patterns of conduct most able to assure safety and operational capability for the mission, themselves, and their fellows. In addition to screening for that and monitoring continued compliance, other actions are needed to provide the highest confidence in candidate selection and retention. Three of these areas are explored in the following.

1. Contracts

Contractual arrangements specifying what the Government expects from operational and direct support populations are a mechanism that could be used to emphasize the seriousness of the relationship, give a better idea of what it entails, and enhance the concept of commitment for the individual. Such a contract instrument would be offered at the time of

initial affiliation with a population operating in or supporting operations in an ERE scenario. If security constraints prevent revelation of actual scenario criteria or position requirements, it would also be possible and advisable to warn the candidate after he/she signs a Nondisclosure Agreement that they should not proceed with the following indoctrination if they are unprepared to accept a major personal and National operational commitment.

No contractual procedure or instrument will sway a person determined not to honor it, and the Government may be unwilling or unable to seek to prosecute such an individual, depending on scenario conditions. In an ERE, however, it would be counterproductive to retain the unwilling even in a pre-operational, preparatory phase. It is felt though that the purpose of the contractual instrument should serve as a means to focus the candidate's attention on the commitment, not as a bludgeon to enforce compliance: persons who fail to honor it would be undesirable for employment under any circumstances.

It is acknowledged that the proposed contract would not necessarily meet the purposes of such tools before the law (if there was no certainty of prosecution for violation); it would be more broadly a "gentlemen's agreement". As such, having only a questionable practical validity in law, legal opinion might well hold that the instrument has no value. Given the potential severity of some scenarios, however, the Government might well be unable to enforce the contract even if it desired to do so. Additionally, from a security perspective the agreement does have validity, purpose, and value in that it gives some evidence of a personal commitment, a stated intention, on the part of the individual, whose personal honor and sense of duty will ultimately be the determining factors in his/her deployment in response to an ERE scenario. Similar documents have been and are being used by Federal agencies for certain populations, with the same legal and security considerations in mind. Naturally, depending on individual and degree of exposure to the ERE, the fight-or-flight reaction may be activated anyway, and best intentions overridden.

2. Grandfathering

While the policy of grandfathering people already in a program in the event of a major policy change or implementation does produce more acceptance from current populations, it also produces inequitable application of policy and allows persistence for an extended time of problems the change was designed to correct. In addition, in a human reliability program of the type envisioned where a monitoring as well as screening program is recommended, it becomes nigh unworkable.

Should the recommendations in this study be adopted to establish an ERE HRP, it will be necessary to assemble a small establishment to create the specialized

instrumentation and mechanisms for the necessary applications. Some of the structural formats proposed require full establishment before use; others can be implemented piecemeal. Regardless, there will be a period of one or more years before effective products are likely to be available. Announcement of the impending program institution over such a timeframe would permit the departure of those who wished to leave with no questions asked, while new accessions could be apprised at or even before affiliation.

R E C O M M E N D A T I O N

1. Deploy an HRP as tested and ready, either piecemeal or wholesale depending upon structural compatibility.

2. Deploy a monitoring program at its widest operational extent when tested and trained.

3. Do front end screening at individual five year bring-up points in conjunction with a single scope background reinvestigation or full field reinvestigation.

3. Ergonomics

Ergonomics is an area that is often ignored to a substantial degree in scenario planning for response to many types of contingency or operational plans including EREs. During short term scenarios, there may be little need to consider the effects of discomfort produced on the population responding, but where functionality is significantly impaired, or during <u>any</u> longer-term (more than a few days maximum) scenarios, lack of attention to ergonomics will have a profound effect on stress tolerance, causing emergence of interpersonal conflict, lowered production, and incorrect decisions and recommendations in an operational ERE. At the same time, care must be taken in the selection of ergonomic devices and tools; as a very limited example, muted coloring and posters of abstract or near-abstract subjects may be helpful to supporting stress tolerance, where bright, clashing colors or posters of scenic wonders or places of personal importance that might be lost as a result of the scenario's occurrence would have the potential to create depression, anger, and an increased sense of loss. Space and costs of ergonomic modification are genuine factors in the decision, but they should be balanced against a carefully considered review of the potential impact of not making the modifications.

R E C O M M E N D A T I O N

Examine (or reexamine) the issue of ergonomics in applicable operational environments, making changes particularly where possible without affecting or having only minimal affect on configurations, with an eye to stress reduction. Use of a specialized contractor for this relatively short term requirement may be advisable.

There are undoubtedly other mechanisms and tools available to enhance motivation in personnel regardless of their status that have not been mentioned in this brief work. There are also many more obvious issues to address even in mature operational systems that might be expected to respond to EREs. The area of ergonomics may well in the event of an operational scenario deployment represent a missing nail in the shoe of the leader's horse.

R E C O M M E N D A T I O N

Explore means of motivational enhancement in operational EREs for personnel responding to them.

E. PHASED RESPONSE

Creation of a particular extreme risk environment requires an appropriately strong response by populations designated to deal with the scenario. In some cases, however, it may not be obviously necessary to deploy all available assets at once, either to retain a reserve for extended operations, or to deal with a less than planned for cataclysm, or for precautionary purposes upon anticipation of an ERE. In the event that it is not clearly necessary to fully deploy assets to face an ERE scenario, it is suggested that a phased response would be the best option until an HRP designed to deal with EREs is established. A phased response would do much to alleviate potential problems in two areas. Such a deployment pattern would, if begun very early or with minimal warning upon initiation of the ERE, present in many cases fewer conspicuous threats to the personal concerns of responding personnel, which should result in an easier decision to report for deployment and thus mean that more personnel will do so. It also allows substitution from later-deploying elements if desired to fill holes in earlier-departing ones. It would allow attempts to be made to substitute for losses due to changed minds if desired and appropriate personnel were available.

If the scenario requires application of operational security (OPSEC) process, a phased deployment would also offer a number of advantages: there would be less activity at any given time to draw adversary attention in a combat situation, there would be a lower operational profile less likely to cause undue alarm to the public, and it would

allow concentration of limited security resources to assist in the OPSEC process for each phase, rather than diffusing assets to cover multiple phases at once.

R E C O M M E N D A T I O N

Consider use of the phased deployment option if viable in a particular ERE context, especially before fielding an HRP for responding populations.

F. NONOBTRUSIVE EVALUATION TECHNIQUES: VOICE STRESS ANALYSIS

In addition to more conventional test and evaluation instruments that might be devised for an ERE HRP, less common techniques such as biometrics may be approaching levels of statistical reliability sufficient to warrant their consideration under certain circumstances as program components. If techniques introduce sufficient interference into individual response as to alter response time or quality or produce other artificialities in behavior or performance, they lose their validity. For this reason, nonobtrusive means are considered to offer better prospects for useful testing and application in an HRP both as a security and as an operational (performance) diagnostic. Nonobtrusive means would be especially valuable in monitoring and even in some screening applications as a way of assessing type or degree of stress. The particular technique chosen for these remarks is voice stress analysis.

A promising but insufficiently proven technology for many years, voice stress analysis is beginning to accumulate enough of a body of research to begin to support some consistent results. Further, it has now passed one major hurdle of acceptability according to Dr. Strome in an interview, in that the National Transportation Safety Board was able to get voice stress analysis accepted as evidence in court for the first time in the case involving the Exxon Valdez. Research has cited seven voice characteristics (Jones, 1990) as offering potential for evaluation; in the reference cited, three of these were examined, and results consistent with prior research were identified that fundamental frequency (pitch) was the best stress indicator for voice.

The purpose of this subsection is not to endorse any particular technique or procedure, but rather to note that there are emerging areas in research that may offer added value to an ERE HRP. Another technique that may be especially helpful in performance evaluation for example might be dichotic listening, which is currently available. Some other biometrics may also be useful.

R E C O M M E N D A T I O N

Have a research effort aimed at developing tools for an ERE HRP also look into valid emerging techniques aimed at nonobtrusive evaluation.

G. PERSONAL RELATIONSHIP ISSUES

Given the definition of EREs used for this study, persons with whom an individual may have close personal ties as members of the same responding team, element, or organization are likely to become casualties. In some ERE scenarios, the magnitude of the threat may be sufficient to present risk of loss of family members even if not collocated with the individual. In either case, an ERE HRP would be forced to deal with a formidable potential factor that might result in failure. This is because of a common tendency of persons to be reluctant to see those emotionally close to them assume risks they themselves might accept. If persons emotionally close to an individual can be spared some of the degree of risk the individual calculates they will be exposed to, he/she will generally seek to prevent their assuming the full degree of risk. This is true even when the act of sparing others is likely to place the person acting in greater personal danger themselves. At the same time, the absence of such relationships might lead to acceptance by the acting individual of an unnecessary degree of risk, as might be readily observed on any highway--single drivers are far more likely to be aggressive or take unnecessary risks than those with a family or carpool in the same vehicle.

The Gordian knot presented by these issues is made even more complex by the fact that emotional ties and responses to them are at least somewhat fluid and to at least some degree perceptually based. Because of them, the individual might not be aware himself exactly what his/her reaction might be to a threat to another person--who could furthermore even be a non-threatening stranger.

Earlier in this study, the issue of personal relationships was cited as being rather outside the scope of this immediate effort. It has been included in this Section because although it has great validity in some scenarios, it has little or none in others. Nor is there any apparent Alexander to resolve all the many interrelated factors presented, including this report--solutions here appear to be only partial ones.

Having stated this, it should also be noted that a combination of approaches to the personal relationships issue may serve to mitigate at least some of the impact of the problem for those ERE scenarios that would be affected. One source interviewed for this study, Dr. Patterson, felt that the issue of questionability of support for family or group members who might also be exposed to an ERE during a participant's involvement was a training, not a selection,

problem. Certainly an absence of training to cope with such issues might cause security and operational threats that could become unmanageable in an ERE that threatens persons emotionally close to the operational and direct support personnel. Such training might (as very brief examples) appeal to immediate team/group ties over non-collocated persons, whose status was uncertain and not readily ascertainable, emphasize inadequacy of the individual's efforts to mitigate effects by themselves, or address other factors leading to increasing personal defenses against perceived threat of loss. Selection processes can also help lower the risk to some degree by screening for personnel predisposed to a number of factors perhaps including the following:

1. Exhibiting low central nervous system arousal.

2. Willingness to leave family or others to whom emotionally close to go do dangerous work.

3. Having a strong affinity for a "higher mission".

Reliance solely on selection will not produce adequate assurance that personnel will report at all, will not report with family in tow where provisions for same had not been made, or will not disrupt operations because of an individually-perceived threat to others emotionally tied to; these variables lie beyond parameters assessable by screening alone. There must also be a thorough, sophisticated, sustained training effort directed specifically at the issue, and monitoring for effect. Spread throughout a population responding to the ERE, this would have the added benefit of encouraging all personnel that their group performance can mitigate the ERE's effects, will mitigate the effects, and must do so. For those ERE scenarios where possible to do so, substantial overmanning and crosstraining offer additional assurance that adequate personnel will be available and functional to support or sustain operations in the ERE.

Complete equity in arrangements and application regarding personal relationship issues is essential in responding to an ERE scenario that threatens more than an individual or group sharing a common likely fate. If some are allowed to make arrangements for protection of others, all must; if some are not, none can. To do otherwise would destroy morale and team or organizational cohesion, preventing effective response. It would also have strong potential to inject personal strife and violence.

H. ALTERNATE SCENARIOS

The authorities interviewed by Mr. Nelson agreed that a scenario the proposed HRP would be used in was necessary as

a baseline in order to develop a workable program. Drs. Crawford and Wiskoff in particular felt that the operating premises for this study were inadequate for effective planning, so Dr. Crawford proposed the following elements as the most basic scenario criteria to define program parameters against:

1. Long or short buildup?
2. Quick or slow response?
3. Multiagency or single?
4. Availability of resources?
5. Screening that could be done before/after an emergency?

Baseline criteria were set forth at the beginning of this study, but the framework of the structures and issues presented in this study seek to address requirements against as many of the parameters cited as possible in order to achieve maximum flexibility for any overall program format ultimately chosen. Should it be decided that the structures and issues presented herein are insufficiently elastic nonetheless, the above criteria may be used for the construction of additional scenarios for special-purpose variants, or even other unrelated scenario and response constitution.

I. COMMUNITY COORDINATION FOR FIT

Each Federal agency and department has its own unique reporting and decision making processes, and each has specific concerns about the formulation of new policy potentially affecting their personnel. This document attempts to identify overall issues about which decisions would be required should an ERE HRP be established with the intention of supporting multiple agencies or departments, but no attempt has been made to deal with department or agency-specific issues. Instead, this study deals with the most basic and essential of larger issues: whether or not an HRP would be needed for effective response to EREs; whether or not an ERE HRP could be designed to be usable in either single or multi-agency situations; whether or not to establish such an HRP; whether or not to participate in development of an ERE HRP as postulated; and which model and format the structure of an ERE HRP should follow. As no purpose would be served by proposing or developing specific tools to fill the structure with until a decision is made to establish an HRP, only processes are identified. It is hoped that the degree of flexibility built into the approach taken in this work will both encourage and enable those interested to undertake the necessary courses of action each must in order to participate in what could be made the most advanced and innovative program of its type. The vehicles proposed are intended to be able to achieve compatibility

with any existing regulations and policies not forbidding participation in any type of HRP.

Although the approach taken in this study is for a single program that might be useful to multiple agencies, there is obviously no requirement that it be administered as a single program for multiple agencies, either. While there are certain financial advantages if several agencies share a program, since most will not have substantial numbers of personnel requiring the intensity of screening provided in an HRP of this sort, an agency wishing to utilize the material developed for an in-house program rather than participating in a multi-agency one can clearly do so.

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Section XII. Summary and Recommendations

A human reliability program seeks to satisfy two basic areas of pertinent inquiry: prediction and detection. Existing systems rely upon minimal predictive means and even less detection. Additionally, the focus of existing programs is chiefly behavioral suitability at selection and administrative followup afterward.

Extreme risk environments of the types theorized for this study require an HRP that will provide not only the most effective feasible security selection and monitoring, but also a mechanism designed to assure that the personnel meeting security needs will also meet critically demanding operational ones: that they will report for duty and be able to function in EREs. Existing HRPs don't offer enough assurance of meeting such rigorous requirements.

The lack of existing HRPs to satisfy the requirements of EREs demanded both exploration of existing research in related areas and development of entirely new designs and processes. In addition to a number of highly flexible formats for program architecture, a number of pertinent or associational throw-offs were generated that address areas beyond the specific scope of this study but which offer hope for an even better program if pursued. A less evident but no less real potential available in most of the models and throw-offs is that though specific structures and issues were addressed, they can also generally be combined in multitudinous other ways and still produce workable, effective results. The architectural models can be used for single-agency up to Government-wide application.

The bottom line is that to assure that EREs can be effectively dealt with requires an HRP designed to do so, that the structures are available to build an ERE program-specific architecture, and that the individual tools for use in the architecture are available or can be developed.

1. Recommendations Summary

Executive Summary: A human reliability program should be instituted to ensure that adequate numbers of personnel capable of meeting both the necessary security and operational concerns are available for response to extreme risk environments.

1. Compile an unclassified version of this study whether or not a classified version is done. (p. II-4)

The Director, OEO, verbally authorized the development of an unclassified version of this report on July 16, 1991.

2. Establish a limited HRP screen even for indirect support personnel for EREs (which could also be used as an initial screen/identifier for operational selection and/or monitoring test instrument). (p. X-4)

3. Implement development, testing, and fielding of an HRP under Security aegis. (p. X-7)

4. Continue with the current select in (Personnel)/screen out (Personnel Security) process with informal select in for teams/staffs not requiring greater formalization of the latter process. (p. X-23)

5. An HRP should be established for appropriate populations, with application of evaluation and monitoring components to meet specific mission criteria as designated by expert professionals. (p. X-23)

6. Use a content and construct validation process as described earlier in this section. Develop/adopt instrumentation as deemed essential by expert opinion to meet mission requirements. (p. X-23)

7. The Modular model appears most effective for meeting the broadest range of screening concerns, capability, and cost effectiveness. It therefore appears to be the best option overall, though it must be noted that: 1) the Mixed model is very similar, and differs primarily in providing somewhat more flexibility offset by more complex administration, and 2) the Sliding Scale is the most comprehensive. (p. X-24)

8. The non-operational model is recommended for inclusion as a first module in <u>any</u> of the larger structures proposed instead of as a stand alone in order to permit ready transition in status and inhibit redundancy in screening. (p. X-24)

9. The Mixed Variable (monitoring) model appears to be the best choice for a single program incorporating disparate populations, scenarios, and missions because it offers the greatest flexibility and coverage in such conditions. (p. X-24)

10. Obtain necessary evaluative and intervention capacity from existing Government sources. Of these, a source with at least limited research interest and capability would be best suited for the needs of an ERE HRP. (p. X-25)

11. Utilize an appropriate security oriented oversight group for a multiple agency HRP. If the effort were to remain within a single agency, oversight should be by the senior security official. (p. X-25)

12. 1) Deploy an HRP as tested and ready, either piecemeal or wholesale depending upon structural compatibility.

2) Deploy a monitoring program at its widest operational extent when tested and trained.

3) Do front end screening at individual five year bring-up points in conjunction with a single scope background reinvestigation or full field reinvestigation. (p. XI-5)

13. Examine (or reexamine) the issue of ergonomics in applicable operational environments, making changes particularly where possible without affecting or having only minimal effect on configurations, with an eye to stress reduction. Use of a specialized contractor for this relatively short term requirement may be advisable. (p. XI-5)

14. Explore means of motivational enhancement in operational EREs for personnel responding to them. (p. XI-6)

15. Consider use of the phased deployment option if viable in a particular ERE context, especially before fielding an HRP for responding populations. (p. XI-7)

16. Have a research effort aimed at developing tools for an ERE HRP also look into valid emerging techniques aimed at nonobtrusive evaluation. (p. XI-8)

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Appendix A

Version 1

1. Are any staff involved with research, test, or evaluation aspects?

May I be shown results? Particularly interested in basis for using procedures (objectives for program, both philosophical and operational), selection/deselection criteria, whether or not there are specific-purpose variants that have been examined, overall effectiveness, impact of life-threatening stressors.

2. Are staff aware of research on the component elements of the overall program, standing alone or together? Results?

3. Are staff aware of research into impact on an individual in program from family/close personal relationships?

4. Has research been done on predictability of functionality in circumstances of threat to life of the individual vice family?

5. In the staff's opinion, what specific factors must be present in an individual to assure ability to properly function in a life-threatening environment? Can they be inculcated? What additional factors must be present to assure ability to properly function if the threat is to immediate family or others similarly close to the individual? What degree of predictability or confidence can be determined, and what degree gained by application of outside affect?

6. If research has been done into functionality of an individual in a threatening environment to self and/or family what degree of confidence is there in predictability for a group under such stress, and over increasing periods of time?

7. What impact can life-threatening stressors be expected to have, immediately and over time, on various age groups and both sexes in otherwise satisfactory health? Can these be effectively mitigated while not seriously impairing functionality?

8. Most regulations reinforce importance of daily observation. Has research been done regarding effectiveness of this aspect? Are there any viable alternatives? Can a program be successful without close observation?

9. Are staff aware of catastrophic failures in screening? Research re same? Results? Solutions?

10. What procedures would have to be undertaken in order to obtain substantially reliable data on questions unanswered?

11. Are staff in contact with others doing R, T & E? Any recommendations?

12. Are existing capabilities at your or other agencies you're aware of capable of handling additional personnel screenings, should they be sought?

13. Assuming research is available to undertake a viable program at X level, what type and extent of resources would be necessary? Are psychiatrists or psychologists (or other specialists) preferred or necessary? What about support/screening staff ratios? Facilities?

Version 2

1. Are any staff involved with research, test, or evaluation aspects?

May I be shown results? Particularly interested in whether there are specific-purpose variants that have been examined, overall effectiveness, impact of life-threatening stressors?

2. Can I obtain a copy of the standard psychiatric questionnaire? What other standard formats, e.g. MMPI, are used in routine or nonstandard testing?

3. Is research, testing, and evaluation ongoing in this area? What areas are/have been explored, and what conclusions have been reached? Can results be quantified?

4. Has research been done on predictability of functionality in circumstances of threat to life of the individual vice family?

5. In the staff's opinion, what specific factors must be present in an individual to assure ability to properly function in a life-threatening environment? Can they be inculcated? What additional factors must be present to assure ability to properly function if the threat is to immediate family or others similarly close to the individual? What degree of predictability or confidence can be determined, and what degree gained by application of outside affect?

6. If research has been done into functionality of an individual in a threatening environment to self and/or family what degree of confidence is there in predictability for a group under such stress, and over increasing periods of time?

7. Most regulations reinforce importance of daily observation. Has research been done regarding effectiveness of this aspect? Are there any viable alternatives? Can a program be successful without close observation?

8. Are staff aware of catastrophic failures in screening? Research re same? Results? Solutions?

9. What procedures would have to be undertaken in order to obtain substantially reliable data on questions unanswered?

10. Are staff in contact with others doing R, T & E? Any recommendations?

11. Are existing capabilities at your or other agencies

that you're aware of capable of handling additional personnel screenings, should they be sought?

12. Assuming research is available to undertake a viable program at X level, what type and extent of resources would be necessary? Are psychiatrists or psychologists (or other specialists) preferred or necessary? What about support/screening staff ratios? Facilities?

13. If your agency were unable or unwilling to process the numbers of personnel involved, would you be able to train other medical personnel in your techniques? How long would training take? Any estimates as to how long it would take to field such a program, and how much it might cost?

Version 3

1. Are any staff involved with research, test, or evaluation aspects?

May I be shown results? Particularly interested in whether there are specific-purpose variants that have been examined, overall effectiveness, impact of life-threatening stressors?

2. Can I obtain a copy of the standard psychiatric questionnaire? What other standard formats, e.g. MMPI, are used in routine or nonstandard testing?

3. Is research, testing, and evaluation ongoing in this area? What areas are/have been explored, and what conclusions have been reached? Can results be quantified?

4. In the staff's opinion, what specific factors must be present in an individual to assure reliability? What degree of predicability or conficence can be determined, and what degree gained by application of outside affect?

5. If research has been done, what degree of confidence is there in predictability over increasing periods of time?

6. Most regulations reinforce importance of daily observation. Has research been done regarding effectiveness of this aspect? Are there any viable alternatives? Can a program be successful without close observation?

7. Are staff aware of catastrophic failures in screening? Research re same? Results? Solutions?

9. What procedures would have to be undertaken in order to obtain substantially reliable data on questions unanswered?

10. Are staff in contact with others doing R, T & E? Any recommendations?

11. Assuming research is available to undertake a viable program at X level, what type and extent of resources would be necessary? Are psychiatrists or psychologists (or other specialists) preferred or necessary? What about support/screening staff ratios? Facilities?

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Appendix B

Terminology

Back-end loading	Focus of the review process is on-the-job performance after affiliation.
Confidence expectancy	The individual's subjectively assigned probability of incurring serious physical injury or death (Keinan, 1986).
Deviancy credits	Inexcusable behavior that is excused/deliberately overlooked due to prior establishment of a good record. (Dr. Glogower)
Dichotic listening	Testing mechanism providing two information streams, one in each ear, slightly out of sync, with alternate tasking by ear. Multiple single tasks can then be layered or used with validated testing measures. Embedded tasks may be included. (Dr. Strome)
Front-end loading	Focus of the review process is on initial selection.
Locus of control	An individual's enduring, cross-situational beliefs about control over outcomes of importance (Barge et al, 1984).
Monitoring process	Continuing review of employees for compliance with standards.
Selection in	Approving only those personnel with demonstrated ability or potential to meet requirements of a specific assignment; all others are disapproved.
Selecting out	Disapproving only those personnel contraindicated by standard; all others are approved.

Selection process	Screening of a candidate to meet standards.
Self-reporting	The reporting of information concerning oneself.
Self-selection	The individual himself choosing a course of action for him/her to pursue.

Appendix C

Experts Interviewed

CAPT Chandler, USN XO, USNH San Diego
MAJ Ronald Chapman, USAF Psychologist, NSA
Dr. Kent Crawford, PhD. Personnel Security Research Center
Mr. Pat Dowd Crew Technology Division, School of Aerospace Medicine
Dr. Douglas Eddy, PhD. NTI, Inc.
COL Joe Fagan, USA Psychiatrist, Office of the Surgeon General, USA
Dr. Edna Fiedler Psychologist, Clinical Research Service, Lackland AFB
MAJ Edwin Gerwell, USAF Behavioral Analysis Service, Lackland AFB
Dr. Harold Ginzburg Psychologist, Public Health Service
LCDR Fred Glogover, USN Psychologist, Psychology Department, USNH San Diego
LTCOL Neil Hibler, USAF Psychologist (Interviewed by S/A Donald Brenno, MI, USA)
MAJ Kolski, USAF Psychologist, NSA
Dr. Martin Kurke Psychologist, Drug Enforcement Agency
Mr. Richard McMurray, Medical Officer, CIA
MAJ John Patterson, USAF Psychologist, Neuropsychology Division, School of Aerospace Medicine
COL John Plewis, USA Psychiatrist, Office of the Surgeon General, USA
Mr. John Reardon Public Health Service
Dr. Richard Rees Psychologist, CIA
Mr. William Robbins Medical Officer, CIA
MAJ Walter Sipes, USAF Psychologist, Neuropsychology Division, School of Aerospace Medicine
Dr. David Strome, PhD. Systems Research Laboratories, Inc.
Dr. Michael Wigglesworth Psychologist, NSA
Dr. Martin Wiskoff, PhD. BDM, Inc.

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